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Responsibility of Commissions

In its first annual report the Missouri Public Service Commission raises the question of its obligation to investors who are influenced in their purchases by the fact that securities have been approved by the commission and therefore supposedly represent value. The commission rightly recognizes this as a "serious and important question." The guide to the policy which the Missouri commission announces it will follow is found in a decision of the New York Public Service Commission, Second District. This case arose from an application of the Hudson Electric Power Company. In approving the New York rule the Missouri commission declares that it is both wise and sound. The New York decision held that to a reasonable extent the interests of the investing public should be considered. "The commission should satisfy itself that, in a general way, the venture will be likely to prove commercially feasible, but it should not undertake to reach and announce a definite conclusion that the new construction or improvement actually constitutes a safe or attractive basis for investment. Commercial enterprises depend for their success upon so many conditions which cannot be foreseen or reckoned with in advance that the duty of the commission is discharged as to applications of this character when it has satisfied itself that the contemplated purpose is a fair business proposition." This problem is a very trying one for the commissions. It is not clear how a state can escape a moral obligation in the matter. Certainly the state cannot fairly approve securities which it knows will not be good in order to help a corporation to get funds to provide needed or wanted service. The burden is clearly upon a commission to do everything that it properly can to make securities issued under reasonably justifiable conditions good.

Protective Resistors for Oil Switches

It is now a well-established phenomenon that when an oil switch is used to connect a considerable length of cable with high-tension alternating-current busbars there is apt to be an overvoltage or an overflow of current during the first few cycles unless the switch happens to close at precisely the right moment in the cycle. A similar phenomenon in regard to overflow of current may occur when the switch is used to connect transformers if the cores of these transformers happen to have been left with a considerable amount of remanent magnetism; that is, if the current happened to be shut off the transformers near a peak in a current wave. Similarly, at the opening of high-tension oil switches under a heavy inductive overload, there is apt to be a severe overvoltage on the switch which may endanger it. Some experiments with oil switches under such circuit conditions are described by Herr von Bruno Bauer in a recent number of *Elektrische Kraftbetriebe und Bahnen*. These experiments indicate that the use of a protective resistor intercalated into the circuit at the opening and at the closing, during half a dozen cycles, has a beneficial influence in wire-drawing these overvoltages and currents, so as to reduce their magnitudes. An approximate theory of the actions occurring in such a switch is outlined, but it is pointed out that no such theory can be completed until the characteristics of arcs occurring under oil have been properly investigated.

Cultivating Long-Hour Appliances

Elsewhere in this issue are given the estimated annual earnings of a considerable number of electric appliances as approximated by the Narragansett Electric Lighting Company, of Providence, R. I., in connection with an analysis of the business of the Electric Shop of this large central station. Close accuracy is, of course, impossible in figures of this kind without the use of separate meters for different devices, and, again, local customs and habits are decidedly influential in controlling the use of such equipment on the purchaser's premises, to say nothing of the stimulation of service produced by rates of from 10 cents downward per kilowatt-hour. But if the values for each appliance expressed in terms of yearly or monthly income are at best estimates, it should not be overlooked that in the absence of more complete data the figures given are highly suggestive on their comparative side and furnish a starting point for further investigations of much interest. A study of the table of incomes shows that a large connected load per appliance by no means always indicates the maximum annual revenue, the conditions being very different from those obtaining in the motor field. It is interesting to note that a 25-watt sewing-machine motor yields a much larger income than a 300-watt soldering iron used only occasionally, that electric irons are among the best customers of central-station service on account of the regularity of their use and the duration of their work, and that a 60-watt heating pad equals a 250-watt foot-warmer or a 350-watt shaving mug in its integrated demand upon the distribution system. None of these devices is to be scoffed at from the standpoint of community electrification, but it is worth studying how much different apparatus is utilized where the central station is trying to develop its business along systematic lines and with the minimum yearly outlay for new plant equipment. The

point should also not be overlooked that often devices of almost zero energy consumption are very effective advertisers of electric service. Load-factor is not everything in the marketing of energy for use in devices for convenience in domestic or business fields, but there is no escaping the fact that long-hour use of connected load is a decidedly profitable thing to encourage, even where the wattage of the equipment units is individually low. If it has not already been done, it is time some central-station man with favorable conditions and a family of fair size put an independent meter on each kind of energy-consuming device in his home for a year and gave the results to the industry. Until a study of this kind is made public, there will be room for much discussion as to the earning power of appliances at stated rates.

Standardization Rules

Certain proposed new standardization rules of the Verband Deutscher Elektrotechniker in regard to electric conducting wires have recently been published in the *Elektrotechnische Zeitschrift*. They relate, in particular, to the conductivity of industrial copper and to insulated wires and cables, their dimensions, loads and tests. The standards for industrial copper are precisely those which were internationally adopted by the International Electrotechnical Commission at the Berlin meeting last September, and which have been subscribed to by the Bureau of Standards, the American Institute of Electrical Engineers and the American Society for Testing Materials in this country. It is thus a world-wide blessing to see copper-wire tables coming into general use which are based on internationally adopted constants. Hereafter "annealed copper wire of 100 per cent conductivity" may be expected to be a phrase possessing the same quantitative meaning all over the civilized world to within a tenth of 1 per cent. This good understanding paves the way for international agreement as to the measurement and determination of temperature changes in coils or windings of copper, with respect to their corresponding changes of electrical resistance.

The standards committee of the American Institute of Electrical Engineers has recently been actively engaged in preparing a new edition of the Standardization Rules. This is a large undertaking, involving many difficulties, owing to the numerous interests concerned, as well as to the many and intricate matters to be dealt with. A draft of the proposed rules is now being prepared by the committee for its final adoption early in June, prior to transmitting them to the American Institute of Electrical Engineers board of directors at the Detroit convention. The new edition will doubtless be distributed among the members as heretofore, after it has been approved, but in the meantime the committee has asked for suggestions from all sides, with a view to making the new edition as nearly satisfactory and complete as possible. The rate of development in electrical industries is such that the several past editions of the American Institute of Electrical Engineers Standardization Rules have become obsolete in a few years, and each new edition has been nearly double the size of its predecessor.

The Flicker Photometer

The flicker photometer is generally regarded by those familiar with its use as decidedly the most reliable means for comparing lights of different colors. It has been shown, to be sure, that under certain circumstances and at high intensities the results obtained by the direct-comparison method do not differ widely from those found by the flicker instrument. This fact, however, is not of great importance when one considers the wide discrepancies found under ordinary circumstances. That the discrepancies are attributable chiefly to the phenomena of simultaneous contrast interfering with direct comparisons has been pretty clearly shown, the more effectively since it is well known that in using Bunsen screens carefully prepared to ameliorate conditions of contrast as much as possible fairly satisfactory direct comparisons can be made. Nevertheless, there are those who hold that while the flicker photometer makes easy a comparison between lights of different colors, it does not necessarily measure their true brightness, but rather some unknown function of the brightness which may not be a more satisfactory criterion than the ordinary equality-of-brightness test. The broad fact which lies at the bottom of flicker photometry is that the color flicker blends and disappears before the brightness flicker, and the fundamental question is whether the disappearance of the brightness flicker really measures equality of brightness.

In an article in this issue Mr. M. Luckiesh deals directly with the validity of the flicker method as a correct measure of brightness. One series of tests seems to clear up the matter more than anything that has yet appeared. According to the first of these, a pure yellow obtained by a suitable light filter was compared with a synthetic yellow composed of green and red light alone. Obviously these could be compared as regards brightness with the utmost ease using the ordinary equality-of-brightness photometer, there being no residual color difference. Now, unless the flicker photometer correctly sums up the red and green components in a synthetic yellow, it will give for that yellow a different brightness value from that obtained in the ordinary way. In point of fact, the results by the two methods agreed within experimental errors of less than 1 per cent. The same degree of equality was found when the lights concerned were nearly white, one from a continuous spectrum and the other a synthetic match of red and blue-green. Under these circumstances the luminosity values of the red and green are added by both methods without involving the phenomena of simultaneous contrast, and the two methods lead to the same result. It is conceivable, as Mr. Luckiesh

says, that other combinations of colored lights might give different results, but it is extremely unlikely in our opinion that such would be the case to an extent sufficient to indicate any uncertainty about the brightness values found by the flicker method. Mr. Luckiesh's results must be regarded as very strong evidence in favor of the flicker instrument for heterochromatic photometry. It does not follow that the flicker photometer is the one always to be used as a matter of practice. As Mr. Luckiesh hints, it may be desirable in ordinary work to use an equality-of-brightness instrument and make corrections for color by means of suitable screens, calibrating these perhaps by the flicker method. Most observers prefer a Lummer-Brodhun screen to any other for rapid and easy work, while generally finding that the flicker instrument is rather slow and causes too considerable a strain on the attention to make it convenient for regular work.

A Real Case of Conservation

In this issue is concluded a description of a plant peculiarly instructive as being a first-class example of a type which has for years been talked about enthusiastically and is now being realized in our own country. It is curious that, obvious as are the advantages of utilizing unmarketable coal at the mouth of the mine for the transmission of electric energy, very little has yet been done toward carrying this important economy into effect. Every ton of coal burned to this good end represents a genuine saving, a reduction in the drain on the world's supply of coal, to say nothing of abolition of an economic waste in carrying fuel when such transportation is really unnecessary. Yet, until the inauguration of the project here considered little had been accomplished in this country and comparatively little abroad, one large South African plant being perhaps the most conspicuous foreign example of the class. It has frequently been demonstrated that where a cheap supply of otherwise unmarketable coal is available a large electric station can produce energy at an extraordinarily low figure and transmit it to great advantage. Such conditions of fuel supply have existed in Pennsylvania and other coal-producing states for a good many years. It was not without appreciation of this fact that twenty-five years ago an electric-light station in Scranton was planted at the foot of a culm pile, from which the firemen could almost shovel fuel directly into the boiler room.

In the present instance the project of electric-energy supply from waste fuel has been carried out intelligently and on a scale large enough to reap the substantial advantages of the plan. The plant is situated in the anthracite territory of the Lehigh Coal & Navigation Company, to which the Lehigh Navigation Electric Company is allied. The plant at Hauto is skilfully laid out for the production of energy at a low cost. The essential feature of the problem in such cases is to provide means for handling the waste coal with the utmost economy. It is necessary not only to transport the fuel to the boiler house as cheaply as possible, but to provide boilers in which it can be burned with the maximum efficiency. Ordinary furnaces are not well adapted for the use of low-grade coal. They lack both grate area and furnace area. In the Hauto plant steam is furnished by eight water-tube boilers, each of which is provided with four grates, half of the grate area being fired from each side. The steam pressure is 225 lb., and there is superheating besides. The fact that the bank of boilers aggregates nearly 2 acres of heating surface will convey to the untechnical mind some notion of the provision made for supplying steam. Six of the eight boilers are hand-fired, the other two being operated by automatic stokers. Comparative results with hand and automatic firing in this work will be watched with a good deal of interest. Generally speaking, automatic stokers are preferred for low-grade fuel, but in this case the situation is different, for the waste product is not similar to the low-grade bituminous coal of the more western fields, and it probably requires more intelligent attention to compensate for variations in its quality than can be secured without hand-firing. The coal is conveyed to the furnaces in the simplest possible manner, for a trestle carries a track of standard-gage equipment directly over the bunkers in the upper part of the boiler house, so that the fuel can be run in on cars and dumped directly into the bunkers, whence it is fed by gravity to the fireroom. There is no need for any considerable coal storage inasmuch as the mine is very near and can be reached at any time.

Water for condensation has been a serious consideration and requires an artificial pond which has a storage capacity of a billion gallons. The condensing water is taken from near one end of the pond and discharged near the other, so that there is ample cooling area to meet all requirements. To give greater facility in dealing with the immense bulk of coal of varying character, the boiler room is equipped with forced draft capable of meeting any requirements in the way of air supply. The generating outfit consists at present of three 12,500-kw turbo-generators, with provision for five more, so that the ultimate equipment rating of the station will rise to 100,000 kw. These generators are wound for 11,000 volts, which well provides for the mines, cement mills and other industries in the immediate vicinity, while the transmission voltage for longer work is 110,000. When one realizes that New York City is less than a hundred miles from this plant, and Philadelphia considerably nearer, the possibilities of disposing of the output are obvious. The turbo-generators are stated to be able to produce a kilowatt-hour for 12.3 lb. of steam, which ought to mean, with the fuel employed, a production cost kept down to a very low figure. The Hauto plant represents a serious and well-planned effort to realize a dream of conservation which has troubled the sleep of engineers for at least twenty years past, and it certainly deserves a degree of success which will make it the forerunner of a new era in the development of energy generation and distribution.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

Los Angeles for Municipal Ownership

By a vote of 56,199 to 23,179 the electors of Los Angeles on May 8 authorized the issuance of $6,500,000 of bonds for the completion of a hydroelectric generating station and the construction or acquisition of an electric distribution system. The campaign was energetically contested by the three electric companies operating in Los Angeles. The City Council refused to accede to a request to permit the question to go upon the ballot in a segregated form, namely, $1,250,000 for the completion of the generating station, upon which $3,500,000 has already been expended, and $5,250,000 for a distribution system. The electric companies offered to buy the energy produced at the aqueduct plant at a price to be fixed by the state railroad commission, the city to fix the price at which the energy would be resold to consumers, but the offer was rejected. It is reported that the intention of the city's administration is to acquire a distributing system by eminent-domain proceedings. There is little doubt that these proceedings will be contested to the limit.

Contest Over Municipal Plant at Springfield, Ill.

The Sangamon Circuit Court at Springfield, Ill., is expected to hand down early in June a decision of importance to public service corporations. The decision will be in the case of Mr. E. W. Payne, a citizen, against the city, brought to secure an injunction to prevent Springfield from combining its light and power plants at the river pumping station and thus producing energy for commercial use and competing with the Springfield Light, Heat & Power Company. Mr. Payne contends that the section of the State public utilities act which exempts from the jurisdiction of the State commission municipally owned utilities is unconstitutional.

The Springfield Light, Heat & Power Company has a franchise from the city, and for many years it has been supplying all private consumers. Some years ago a municipal plant was organized to provide energy to light the streets. The Commissioner of Public Works, Mr. Willis D. Spaulding, about a year ago conceived the idea of combining the city light plant and city waterworks plant and selling energy. Many people opposed the plan, so the city officials began to install an electric plant at the water-works by piecemeal. It was proposed to buy a 750-kva generator, and then to add other units, and in the meantime to keep the city's electric plant in operation independently. A referendum election was held and the people voted in favor of the plan.

It was after the Council had passed the ordinance providing for the purchase of the generator that Mr. Payne brought his injunction proceedings. He contends that the city must get permission from the Public Utilities Commission before installing the generator. The city points out the section in the act which gives cities the right to proceed independently of the commission, and Mr. Payne in turn contends that the section is not valid because it gives the city an advantage over the private company to the detriment of the company, thus violating the federal constitution.

Pittsfield A. I. E. E. Meeting

As noted on page 968 of our issue dated May 2, a meeting of the American Institute of Electrical Engineers will be held in Pittsfield, Mass., on Thursday and Friday, May 28 and 29, to discuss the general subject of "Relative Advantages of Star and Delta Connections." Sessions will be held on Thursday morning and afternoon and on Friday morning, afternoon and evening. In addition to the papers by Messrs. D. W. Roper, J. P. Jollyman, P. M. Downing, F. G. Baum, Louis F. Blume and Charles Fortesque, referred to in the earlier notice, the following papers will be read: "Inherent Voltage Relations in Star and Delta Connections," by Messrs. R. W. Sorensen and W. L. Newton; "Harmonic Voltages and Currents in Star and Delta Connected Transformers," by Mr. R. C. Clinker; "Relative Merits of Star and Delta Connections for Alternators," by Mr. T. S. Eden. Written discussions by Mr. Guido Semenza, of Milan, Italy; Mr. Ferdinand Koscherak, of Paris, France, and Messrs. Cassius M. Davis and C. P. Steinmetz, of Schenectady, N. Y., will also be read.

Prof. Dugald C. Jackson, of the Massachusetts Institute of Technology, will preside at the meeting in place of Mr. John J. Frank, chairman of the Pittsfield Section, who finds he is unable to be in Pittsfield during the meeting. The entire program will be summarized and discussed at the close of the meeting by Mr. Percy H. Thomas.

The local arrangements committee in charge of the meeting is composed of Mr. Paul R. Smith, chairman, and Messrs. M. O. Troy, H. W. Tobey, H. P. Ball, V. E. Goodwin and Neal Currie.

On Thursday evening members of the Institute will meet the members of the Berkshire County University Club at a dinner to be served at the Maplewood Hotel. Mr. William Stanley will be the chief speaker on this occasion.

Cleveland Meeting of I. E. S.

The regular monthly meeting of the Pittsburgh Section of the Illuminating Engineering Society, which embraces Cleveland in its territory, will be held in the latter city on Friday, May 22. It had been originally intended to hold this meeting on Friday, May 15, but at the suggestion of the Cleveland members it was decided to postpone the meeting until the later date so that the members could visit the Cleveland Electrical Show, which will be in progress at that time. The Pittsburgh delegation will go to Cleveland in a special car. The meeting will be held in the early part of the evening, after which the society will be guests at the Nela Park Laboratory. A paper will be presented at the meeting by Mr. Ward Harrison on the illumination

of building exteriors and one by Mr. C. L. Dows on the latest development in incandescent lamps. The reading of the papers will be followed by discussion.

Niagara Development Bill

At a conference which was held in Washington on May 13 between Secretary of War Garrison and representatives Harrison, Cline and Cooper, for the House foreign affairs committee, a compromise bill to regulate the water diversion rights at Niagara Falls was agreed upon. The bill gives the Secretary of War the right to issue revocable permits for a daily diversion averaging 15,600 cu. ft. per second on the American side and for the importation of 250,000 hp from the Canadian side. The control over the rates, tolls and service would be left to the State of New York.

Electrical Supply Jobbers' Convention

The regular quarterly meeting of the Electrical Supply Jobbers' Association was held at the Hotel Chalfonte, Atlantic City, N. J., on May 12 and 13. The attendance was excellent, the sessions being given over entirely to routine matters pertaining to the jobbing business.

Definite action was taken on the report of the special committee of the Chamber of Commerce of the United States of America on trust legislation in regard to the proposal to create an interstate trade commission. The association voted favorably on all sections of Referendum No. 7 except the third. This ballot, which was taken for the guidance and instruction of the board of directors of the Chamber of Commerce, provides for the creation of an interstate trade commission of at least five members, whose jurisdiction in conducting investigations shall extend to all corporations engaged in interstate or foreign commerce. The committee recommends that the commission should not now be given authority to advise applicants concerning the legality of proposed contracts, combinations, etc., under the Sherman act. In annual reports corporations ought not to be required to disclose trade processes, shop costs, classification of sales and profits among particular articles, names of customers, or other like private information. Publication of facts obtained by the commission should be confined to such as are of public concern. Congress should direct the commission to investigate and report at the earliest practicable date on the advisability of amending the Sherman act to allow a greater degree of co-operation in the conduct and the protection of the foreign trade.

A general discussion was also had on House Bill No. 13,305, known as the Stevens bill, the purport of which is to give the owner of a patent or trade-mark the right to fix the resale price of the article to which the patent or trade-mark applies.

During the year the Electrical Supply Jobbers' Association has been gathering data on rubber-covered wire, and the trade statistics thus secured were presented in closed session on Wednesday morning. Other routine matters brought up for consideration were the subjects of cash discounts and the return of goods.

On Wednesday night a rejuvenation of the Jovian Order was held at the Hotel Rudolph, followed by a banquet and entertainment in the same hotel. The next meeting of the association will be held in September, the date and place to be decided later. The November meeting will be held at Birmingham, Ala., as announced at the February Washington meeting.

Electric Vehicle Association

Owing to the increased interest generally evident in electric vehicles and the volume of work to be disposed of, three days, rather than the usual two days, will be allotted to the fifth annual convention of the Electric Vehicle Association of America, which will be held in Philadelphia Monday, Tuesday and Wednesday, Oct. 19, 20 and 21, during the week of the Philadelphia Electric Show, at which there will be a comprehensive exhibit of both passenger and commercial vehicles.

In addition to the sections in New England, Chicago, Philadelphia and Washington, the Electric Vehicle Association of America has recently added Cincinnati and San Francisco, and additional sections are to be announced shortly. The officers of the Cincinnati Section are: Mr. George Behlen, the Charles Behlen Sons Company, chairman; Mr. James W. Schrantz, Westinghouse Electric & Manufacturing Company, vice-chairman; Mr. Parker H. Kemble, Union Gas & Electric Company, secretary. The San Francisco officers are: Mr. Stanley Walter, Pacific Gas & Electric Company, chairman; Mr. C. W. Hutton, General Vehicle Company, vice-chairman; Mr. J. W. Redpath, *Journal of Electricity, Power and Gas*, secretary.

Speaking in Chicago on May 5, Mr. Frank W. Smith, president of the Electric Vehicle Association of America, related some facts of interest at the annual meeting of the local section. When Mr. Smith took office, about Nov. 1 last, there were 434 members of the association. The number at present is about 675. Local sections are in existence in Boston, Chicago, New York, Philadelphia, Washington, Cincinnati and San Francisco, while there are good prospects for the organization of sections in Pittsburgh, New Orleans, Detroit, Los Angeles, Cleveland and other cities. Mr. Smith mentioned the fact that the association may become international in its scope. He devoted considerable time to the work of committees and said of the pamphlet entitled "The Electric Vehicle in Parcel Post Service for Economy and Reliability" that 10,000 copies had been distributed. One of the most recent efforts in which the activities of the association are expressed is the endeavor to induce steam-railroad men to give consideration to the merits of the electric truck as a medium for relieving freight terminal congestion in large cities.

Electric Vehicle Course at Armour Institute

An announcement of considerable interest was made at the recent annual dinner of the Chicago Section of the Electric Vehicle Association on May 5. Among the speakers was Dean H. M. Raymond of the Armour Institute of Technology, Chicago. President Frank W. Smith of the national organization had previously referred to the work of the education committee, which the association deems of much importance. Dean Raymond announced that the Armour Institute is about to establish a course of instruction in the practical care and operation of electric vehicles. As outlined by Prof. D. P. Moreton, who will be in charge of the new course, the students will be instructed in the history and development of the electric automobile and the fundamental principles underlying the design and operation of the electric motor, the controller and the storage battery. Methods for charging will be explained as well as the use of measuring and recording instruments. One of the lectures will contain hints on good driving, while others will relate to cost data, records, etc. The course as planned will relate to fundamentals rather than to technical refinements and is designed, appar-

ently, for young men employed, or who expect to be employed, in the operation of electric vehicles. Instruction will be given during the evening so that those employed during the day may attend.

Activities of the Society for Electrical Development

As noted in our issue of April 25, the annual meeting of the Society for Electrical Development will be held at the Bellevue-Stratford Hotel, Philadelphia, Pa., on June 1. This plan will enable those going to Philadelphia for the convention of the National Electric Light Association to attend also the meeting of the Society for Electrical Development, which will be held at 10 a. m. At the Friday morning session of the National Electric Light Association Mr. J. M. Wakeman, general manager of the society, will outline the plans for electrical development. These plans have been carefully worked out by a special committee and have been approved by the executive committee of the society. The staff for putting them into execution has been engaged, and the society is now actively at work along the lines indicated below:

Field Co-operation

Local Co-operation.—The plan is to organize the allied interests into local leagues, to secure the personal support and co-operation of the members of the society in each district, so that they will all work together for the intensive cultivation of the electrical business in the territory in which the local organization is formed.

Part of this local work is to be done through co-operative advertising, through aiding in local legislation, local inspection of wiring, local wiring codes, etc.; also through being able to present to the local governing body ordinances regulating electric signs, street lighting, etc., in other cities.

This department also will be prepared to co-operate with the local interests in the preparation of electrical pages and to furnish information regarding electric shows.

It is intended that the society should take an active part in conventions, not only of electrical interest, but in all conventions where users of electricity get together. Arrangements will be made for papers to be presented by representatives of the society on some application of electricity of interest to that particular convention.

General Co-operation.—The field representatives of the society will devote a portion of their time to co-operation with architects, builders and engineers, so that these may be informed as to the proper method of writing specifications for installations for electric light, heat and power; thus the specifications will embody the use of everything electrical that is available on the American market.

As the textbooks used in public schools on electrical subjects are very apt to be behind the times, the department will co-operate with the publishers of textbooks with the view of bringing them up to date.

It is also the intention of the society to co-operate with school boards by furnishing moving-picture films, lectures and stereopticon exhibitions showing the progress in the world of electric service. In this work the local central-station company is expected actively to co-operate. Visits to large manufacturing plants where electric drive and other uses of electricity could be pointed out will also be arranged for high schools.

There are numerous business men's associations throughout the country, and by putting jobbers, contractors, manufacturers and central stations in closer touch with these boards of trade, chambers of commerce and other business men's associations, great good can be accomplished.

The section will continue the campaign for membership and in a general way keep the allied interests fully posted on the work of the society.

New Development

The society has engaged as a traveling investigating engineer a man whose experience in the electrical field has particularly fitted him for the work of compiling up-to-date information as to the various uses of electricity in the different industries and suggesting every possible use of electricity for light, heat and power in factories, mills, etc., as well as in the home and on the farm.

It is very difficult at the present time to secure such information. Some of it has been published in different periodicals, but it has not been brought together in a comprehensive way. Information as to the requirements of various industries, together with the price per unit of output that the consumer could afford to pay for energy, would be invaluable to central-station companies. Analyzing the application of electricity to the industries will undoubtedly show that none of them has been equipped to the limit of possibility, and the society purposes to make practical suggestions as to the further uses of electricity in all industries.

There is a great work to be done for central stations throughout the country in developing an increased demand for electric service in the home. This can be done to a large extent by securing and disseminating information among the central-station members as to how such a demand has already been developed elsewhere and outlining new-business campaigns.

There are innumerable examples of heating throughout the country, but the number of them in use in proportion to the prospective list is absurdly small. There is no place where one can obtain information covering what has been done in this connection, much less what might be done. The Society for Electrical Development will help central-station companies to get this kind of business and to bring the manufacturer, central station and dealer together in the production and sale of such apparatus.

Commercial Exchange Bureau

The Commercial Exchange Bureau will work in very close co-operation with the section for field co-operation, and the society has engaged as manager of this bureau an electrical engineer who is thoroughly capable of collating, indexing and filing the information gathered by the latter section and from all other available sources.

This bureau will prepare bulletins or pamphlets explaining the various uses of electricity, prepare data for articles of similar character for the trade journals and for convention papers, and carry on the necessary correspondence upon such subjects with the members of the society and the public.

Editorial and Advertising

News items and electrical stories for local papers, describing electrical inventions, improvements or applications, compiled in news form so that electrical stories will be accepted by the press on their merit as news, will be prepared by the society.

The society plans to provide an advertising copy service for members to assist them in conducting their advertising in the best possible manner; also to carry on discussions in regard to newspaper advertising before meetings of the Electrical Contractors' Association, the Electrical Supply Jobbers' Association, the National

Electric Light Association, etc., so that the greatest number of concerns engaged in the electrical business will be informed upon the value of newspaper advertising and how through this means to bring about increased interest in and demand for everything electrical.

General Publicity Special Writers.—This part of the society's plans provides for well-written stories by magazine writers of good reputation, suggesting the use of things electrical by the householder, by the merchant and by the factory owner, the stories to be prepared by men of ability so that they will either be accepted on their merits or be sufficiently interesting to be paid for by the publishers and in this way cut down the cost to the society of having this work performed.

Moving Pictures.—The society has arranged for the preparation of moving pictures suggesting the use of things electrical, illustrating their uses in the home and the factory and on the farm. This is one of the most effective methods of interesting and educating the public to "Do It Electrically."

Window Trimming.—The society has arranged to have a number of windows trimmed with electrical supplies, the displays to be made in a novel and effective manner, two photographs to be taken, one showing the fixture setting and the other showing the completed window. These photographs to be reproduced in halftone and sent to the members of the society who have show windows, together with printed instructions as to how to dress the windows to obtain the effects shown in the photographs. Such photographs and instructions will be sent out at regular intervals during the year, and it is felt that this work will give the smallest and the largest member a concrete exhibit of the definite help that the society is in a position to furnish its members. From the experience of large manufacturers specializing in this form of advertising, it is felt that this is one of the most important activities that the sociey can participate in for the development of the electrical industry.

Progress on Pennsylvania Railroad Electrification

Preliminary and to some extent experimental construction work is already well under way on the electrification of the Pennsylvania Railroad's main line from the Broad Street Station, Philadelphia, to Paoli, Pa., 20 miles distant. Following the completion of this work the Chestnut Hill branch will also be electrified, the single-phase system to be used in both instances. This will provide for a movement of forty-nine inbound and forty-seven outbound suburban trains a day. Through passenger and all freight trains for some time to come will continue to be handled by steam locomotives.

Reasons for Adoption of Single-Phase

As explained by Mr. George Gibbs, consulting engineer on the Pennsylvania's electrification work, the single-phase system of operation was adopted not so much as a result of calculations based upon the conditions existing on the suburban line being equipped but, rather, as a logical step toward the accomplishment of the Pennsylvania's electrification plans as a whole. The general reasons for the decision to use single-phase have been that the type of overhead construction for this system and the method of transmission make possible the use of any type of tractor which has so far been suggested in the history of steam-railroad trunk-line electrification. In addition, the apparatus as installed especially for the single-phase system is available for the split-phase locomotive, for any of the various types of single-phase motors, or for the use of the rectifier in case that becomes a practical commercial development. There exist also the advantages of high transmission voltage and ease of transformation from three-phase, twenty-five-cycle lines. The proposed installation includes consideration only of the multiple-unit car service for the suburban traffic. For the present no electric locomotives are to be operated over the

FIG. 1—CONSTRUCTION GANG AT WORK ON OVERHEAD ABOVE PASSING STEAM TRAINS

line. Each of the cars will be equipped with two 225-hp single-phase, commutator-type motors, both mounted on one truck.

Overhead Construction

Electricity will be furnished from an overhead catenary system carried on supports of the cross-catenary type. In this arrangement no structural steel bridges are used except the anchor bridges at half-mile intervals, but instead a span wire of heavy cable is carried across the tracks between two tubular steel poles at 300-ft. intervals. From this is suspended a single longi-

FIG. 2—OVERHEAD CATENARY CONSTRUCTION AT ST. DAVID'S, 14 MILES FROM PHILADELPHIA

tudinal catenary with a secondary messenger wire of copper and a trolley or contact wire of bronze. This cross-catenary type of overhead construction over a four-track main line has never been used heretofore in this country.

The longitudinal catenary consists of a messenger cable supported from the cross-catenary cable, and

from this in turn is suspended the secondary messenger and trolley wires, both of the latter being practically horizontal. The secondary messenger wire acts as a conductor as well as a means for producing flexibility in the trolley wire, against which run the pantographs of the cars. In general the use of two lower wires is well known abroad and also in this country through the

FIG. 3—ANCHOR BRIDGES OF THE TYPE TO BE ERECTED AT HALF-MILE DISTANCES

installation of the New York, New Haven & Hartford Railroad and the New York, Westchester & Boston Railway, but on the Pennsylvania installation the method of supporting the contact wire from the secondary messenger differs materially from that heretofore used. Small two-piece clips fasten the wires together at intervals of about 15 ft., and between every second pair of clips, or at intervals of about 30 ft., a hanger from the catenary is attached to the upper wire. In the previously mentioned installations a hanger is installed between every pair of clips instead of between every second pair, so that the new form of construction obviously

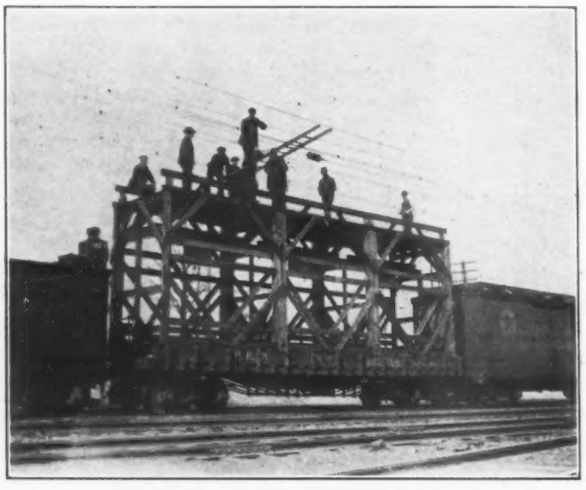


FIG. 4—CONSTRUCTION GANG WORKING FROM PLATFORM ON FLAT CAR

reduces the number of hangers from the catenary cable without necessarily reducing the number of clips.

Arrangements for Central-Station Energy

Under the terms of the contract with the Philadelphia Electric Company which will supply the energy to operate the Pennsylvania's electric trains, the initial minimum of 3750 kw is to be ready in September of this year. The railroad will erect its own substation at a point opposite the Christian Street plant of the electric company and will purchase twenty-five-cycle energy at 13,200 volts. A minimum load-factor of 25 per cent is specified.

The rate for this railroad service will be made up of a stand-by charge for kilowatts of demand and an energy charge per kilowatt-hour consumed. The rates will be increased proportionately if the power-factor is less than 70 per cent. When the railroad company can guarantee a maximum demand of 15,000 kw and 35 per cent load-factor the rate will be proportionately reduced.

Chicago Fire Protection Convention

Sustained interest in the important subject of fire prevention was shown by the members and visitors who, to the number of about 250, attended the annual convention of the National Fire Protection Association in Chicago on May 5, 6 and 7. President Robert D. Kohn, of New York, occupied the chair, and Mr. Franklin H. Wentworth, of Boston, the secretary and treasurer, also occupied a seat on the platform. In his annual address Mr. Kohn laid stress on matters of education and legislation to the end of safeguarding life and property from fire hazard.

Mr. F. J. T. Stewart, of New York, as chairman, presented the report of the executive committee. One interesting recommendation, which was adopted, was that the association take no action in the matter of changing rules or standards without consulting the manufacturers or others interested. Resolutions were adopted calling upon all citizens to aid in the campaign against fire waste. To this end certain measures are advocated. These consist of such recommendations as the use of fire-resistive building material, the installation of automatic sprinklers and the like.

The secretary's report showed a total membership of 2635. Active members consist of institutes and societies to the number of 121. A committee recommended certain amendments to the articles of association. One of these proposes to change the name to the American Fire Protection Association. This amendment was referred back to the committee for further consideration.

Municipal Fire Prevention

Mr. Robert Adamson, Fire Commissioner of New York City, delivered an address on "Municipal Fire Prevention." He emphasized the need of interesting business men of the country in the subject of fire protection. The great problem is that of education. The Fire Prevention Bureau in New York City is only two years old. Uniformed men of the fire department inspect all buildings except private residences. In the first three months of 1914 325,000 inspections of this character were made. A picked man from each of the 300 fire companies in the city is detailed for this purpose. These firemen-inspectors make recommendations to the owners or managers and, in addition, report dangerous conditions to the Fire Protection Bureau. The value of the inspection is shown by the fact that the records show that those businesses classed as most hazardous have few fires. Most fires are due to the carelessness of the people.

Features in the Work of Underwriters' Laboratories

Mr. William H. Merrill, Chicago, manager of the Underwriters' Laboratories, spoke of the new features of the work. In addition to the large Chicago plant a station has been in service in New York for about a year. The New York equipment is devoted almost ex-

clusively to electrical testing. It is now quite immaterial whether an electrical device is tested in the Underwriters' Laboratories at Chicago or at New York. Although the volume of electrical testing at Chicago has not decreased, the New York plant is doing as much electrical work as the Chicago plant. The Underwriters have established laboratories in London to inspect goods to be admitted to Canada and the United States. There is some prospect of this work being extended to Germany and Italy. Mr. Merrill said that he realized the importance of field work in inspecting materials, and he explained how this work is done. He described the label service and the follow-up system as exemplified in field inspection.

Electric Fire Pumps

The report of the committee on fire pumps was presented by Mr. H. O. Lacount, of Boston. The committee offered some amendments to the specifications for steam pumps, but devoted the greater part of its report to rules and requirements for electrically driven fire pumps. The new rules provide that the drop in potential for circuits supplying energy to electric fire pumps shall not be over 5 per cent for direct-current motors or 8 per cent for alternating-current motors. Transformers must be placed in a separate room or outdoors. Direct-current motors must be of the shunt-wound type; alternating-current motors must be of the wound-rotor or squirrel-cage induction type. The squirrel-cage motor may be used only when the conditions are such that it will surely start and attain full speed. It is required that motor windings be thoroughly impregnated with waterproofing compound. The report of the committee was approved for reference to the executive committee. Mr. Forster, of Philadelphia, Mr. Fitzhugh Taylor, of Chicago, and others took part in a brief discussion.

Controlling Equipments for Electric Fire Pumps

In the absence of Mr. Dana Pierce, of New York, chairman of the committee, Mr. William S. Boyd, of Chicago, read the report on controlling equipments for electric fire pumps. Specifications were presented covering controlling equipments for both the manual and the combined manual and automatic types for electric motors driving fire pumps. In the manual type it is provided that the operation shall be such that the motor is directly started by a single lever which, except in auto-starters or compensators, shall be arranged to move in one direction from the initial to the final position. Electrical actuating devices will not be approved with this type. In the combined manual and automatic type the automatic operation shall be initially actuated by an approved pressure governor acting directly on the winding of a solenoid or other device or devices which, in turn, shall close the main contact and a series of rheostatic switches admitting energy to and cutting out starting resistance from the motor circuits.

There was some discussion on this report, in which Messrs. H. O. Lacount of Boston, Fitzhugh Taylor of Chicago, F. J. T. Stewart of New York, J. H. Brumbaugh of Chicago and others took part. In relation to automatic starters it was said the manufacturers are ready to provide these devices. For electric fire pumps something better is required in the way of starters than for commercial pumping equipments. One provision of the report was to the effect that where direct current is used an auxiliary field rheostat must be provided. The word "must" here was taken out and the word "may" substituted. There was some discussion also on the use of fuses in motor circuits, the provision of space on motor-control panels for watt-hour meters, and the temperature inside the cabinet at the end of the test period. Some sections of the report were referred back to the committee, but, with these exceptions, the report was adopted and referred to the executive committee for promulgation.

Signaling Systems

In the absence of Mr. Ralph Sweetland, of Boston, chairman of the committee, Mr. W. S. Boyd, of Chicago, presented a brief report on signaling systems. Some changes were suggested in the provisions relating to municipal fire alarms. The committee was continued.

Electrical Committee Takes No Action on Refillable Fuses

Mr. Boyd also presented the report of the electrical committee, of which Mr. F. E. Cabot, of Boston, is chairman, and Mr. Ralph Sweetland, of the same city, secretary. The report of this committee was short. No changes in the National Electrical Code have been made during the year. A sub-committee on high-potential lines is in conference with other organizations to endeavor to bring about a national standard for this kind of construction. In relation to the interesting subject of fuses the committee said:

"At the meeting held April 1 the subject of refillable fuses was brought up, and after careful consideration it was voted that the committee did not consider it desirable or proper to recommend at this time any action, either favorable or unfavorable, as to changes in code rules regarding the construction of inclosed-type fuses. Other fuse questions also were considered, and the committee decided to recommend a change which will allow inclosed fuses in multiple where the capacity of the circuit is greater than the largest standard inclosed fuse now made."

The question of appeals between inspectors and contractors, which has now become a matter of considerable importance, was considered by the committee, and a standard set of rules for handling such matters was adopted. Consideration was given to the case of the city of Providence, R. I., where 250-500-volt systems are used for both alternating-current and direct-current distribution. It is believed that satisfactory changes in the code can be made to meet the Providence situation.

The committee's report was accepted and referred to the executive committee, and the committee was continued. The members of the committee, in addition to the gentlemen named, are Messrs. W. H. Blood, Jr., Boston; George E. Bruen, New York; J. E. Cole, Boston; Washington Devereux, Philadelphia; J. C. Forsyth, New York; C. M. Goddard, Boston; C. H. Hill, Philadelphia; H. O. Lacount, Boston; C. H. Lum, New York; E. McCleary, Detroit; Farley Osgood, Newark; F. Overbagh, Chicago; A. M. Paddon, Syracuse; Dana Pierce, New York; A. M. Schoen, Atlanta; Martin Schreiber, Newark; R. P. Strong, New Orleans; C. M. Tait, Montreal; V. H. Tousley, Chicago; H. S. Wynkoop, New York.

Election of Officers

Officers were elected as follows: President, Mr. Robert D. Kohn (re-elected), New York; first vice-president, Mr. Charles E. Meek, New York; second vice-president, Mr. Louis Wiederhold, Jr., Philadelphia; secretary and treasurer, Mr. Franklin H. Wentworth (re-elected), Boston; chairman of executive committee, Mr. F. J. T. Stewart (re-elected), New York; new members of executive committee, Dr. S. W. Stratton, Washington, D. C., and Messrs. James White, Ottawa, Ont.; R. P. Miller, New York; C. H. Patton, Cleveland; C. L. Scofield, Montreal; F. M. Drake, Louisville, and C. M. Goddard, Boston.

The nominating committee for next year consists of Messrs. W. E. Mallalieu, New York; D. Everett Waid, New York; C. H. Phinney, Boston; W. H. Merrill, Chicago, and H. L. Phillips, Hartford, Conn.

Testimony on Regulation of Public Utility Holding Companies

A hearing on the holding-company feature of the Newlands interstate trade commission bill was held before the interstate commerce committee of the United States Senate at Washington, D. C., on May 12. Testimony was presented by Messrs. Bernard Flexner, representing the Middle West Utilities Company, of Chicago; Charles K. Beekman, of Beekman, Menken & Griscom, representing the United Gas & Electric Corporation and the American Cities Company, and Stuart G. Gibboney, of Barber, Watson & Gibboney, New York, representing Bertron, Griscom & Company and William P. Bonbright & Company, Inc. The testimony was entirely on the public utility holding company.

Testimony of Mr. Flexner

Mr. Flexner, the first witness, described the position of the Middle West Utilities Company, a Delaware holding company. An office is maintained in Wilmington in order to comply with the law, but the main office of the company is in Chicago. Two aspects of the bill were taken up. One is the prohibition of the holding of stock by another corporation and the other is the provision that all stock issued shall be sold at par. Mr. Flexner cited as an example of a subsidiary company engaged in interstate business the Twin State Gas & Electric Company, which transmits electrical energy across state borders.

In the operations of the holding company various instances have arisen where the communities served desired to permit the consolidation of competing companies. In such cases competition would be destroyed. The absolute purpose in such a consolidation is to rid the community of competitive conditions. In some cases actual consolidation might not be possible owing to the existence of an outstanding stock interest, so that instead of a conveyance there might be substituted the holding-company feature.

Discussing the general subject of state regulation, Mr. Flexner said that it has been recognized uniformly by the commissions that the way to regulate is to avoid competition between utilities of one class in each community. Of the thirty existing state commissions, nineteen or twenty in express terms permit the acquisition of stock of operating companies and the transfer of franchises with the approval of the commissions. Gas and electric lighting companies in the same district are generally recognized as competitive forms of business.

Senator Cummins asked whether the witness thought that the gas and electric business should be controlled by one company.

Mr. Flexner said that there are certain economies in the administration of two properties as one. Where the entire situation is subject to regulation by the state commission there is ample protection for the public interest. Congress might very easily legislate on this subject in such a way that a particular state might feel that it had acted in the interest of a particular community. So far no court of last resort has held that a holding company owning securities is engaged in interstate commerce.

The history of the industry, Mr. Flexner added, shows that the development of the holding company has made it possible to give service to many small communities which would otherwise be without any service. It has been a factor in the social development of the community. It has brought twenty-four-hour service to communities that formerly had service only at night.

Referring to Section 12 of the bill, Mr. Flexner said that, while he was in entire sympathy with what the committee has in mind, it appeared to him that the committee might consider the ways in which the various states have handled the question. These states, instead of tying the hands of their commissions, have provided that securities should be issued on terms subject to their approval. The section in the bill gives no leeway to a commission. It is not always possible to sell stock at par. Although not urging the issue of stock for no consideration, Mr. Flexner urged that power be lodged with the commission to say what price should be required. Generally stock is sold at a discount of 10 to 15 per cent.

Commenting on instances cited by Senators Pomerene and Newlands showing the issue of securities without specific value in the promotion of properties or enlargement for improvements, Mr. Flexner said that undoubtedly there had been serious abuses. In California one company which wanted to issue securities to reimburse its treasury for $1,800,000 spent on additions and betterments was denied permission so to do by the Railroad Commission, which took this method of taking part of the water out of the capitalization. The addition of water to capitalization cannot take place to-day where state commissions have regulatory power.

Argument of Mr. Gibboney

Mr. Gibboney referred to the brief filed with the committee and also to a brief filed with the judiciary committee of the House of Representatives in regard to the bill on the same subject pending before that committee. These briefs are supported by appendices quoting from the utterances of prominent authorities, including Mr. Wilson before his election as President. The briefs are signed by Mr. Gibboney and Barber, Watson & Gibboney, of New York; Mr. Flexner and Mr. Ralph D. Stevenson, of Chicago, and Messrs. H. Alexander Smith, Daniel W. Knowlton and George B. Hatch, of Colorado Springs, Col.

Supporting the argument in the briefs, Mr. Gibboney asked for the insertion of a clause definitely excepting public-utility-holding companies from the operation of the bill. He argued that regulation by state commissions has been effective and has been largely the answer to the demand by the public for municipal ownership and operation. Through the law enacted by New York State in 1907 under the direction of Governor Hughes the entire cry for municipal ownership was allayed.

Under the New York statute competitive lighting companies may be brought together by permission of the commission through a holding company. Texas does not permit such a form of combination. The states are not uniform in their ruling as to whether gas and electric companies are competitive. It would work great harm for the federal government to interfere in this situation.

Over $8,000,000,000 of capital is employed in public utilities, of which $5,500,000,000 is held through holding companies. As an instance of the possible effect of legislation, Mr. Gibboney cited the Appalachian Power Company. This company operates in two states. It reaches the town in which the witness was born and where the lighting company went through financial difficulties from time to time before the property was acquired by the large power corporation. Previously the streets had not been lighted. Now improvements have been made and rates reduced. If Congress enacts legislation on this subject, it will be taking powers from the states that they have developed. The states are in a better position to regulate within their borders than Congress.

Mr. Gibboney declared that a great advantage of holding companies is that they are able to take broken-

down plants and develop them with money raised in larger cities or abroad. Over $300,000,000 of holding-company securities were sold in Europe last year. With such capital the holding companies improve service and reduce rates of operating companies. They average the risk of the small investor. It is found that investors will not buy securities of plants situated in small towns, while they will buy securities of holding companies controlling many small plants.

Continuing, Mr. Gibboney declared that in his judgment the United States Supreme Court would hold that practically all public-utility-holding companies are engaged in interstate commerce. He has figured that about 20 per cent of the holding companies have properties that are actually engaged in commerce between the states. An Idaho company is conducting operations in three states. Mr. Gibboney suggested that the following exception be added at the conclusion of Section 13 of the bill:

"These sections shall not apply to corporations acquiring or holding the stock of, or engaged in the business of conducting, a public utility which is subject to state regulation, other than common carriers as defined in the act to regulate commerce, approved Feb. 4, 1887, and the amendments thereto."

Mr. Beekman on Two Holding Companies

Mr. Beekman explained the scope of operation of the American Cities Company and the United Gas & Electric Corporation and said that these two companies are typical of all others. They are essentially investing companies. They are not controlled by a large moneyed interest, but their ownership is scattered through the holding of their securities in small lots throughout the country and in Europe. Such companies are not controlled by cliques of bankers but banking houses advise and assist in their operations.

In the last few years the United Gas & Electric Corporation has acquired various properties in the West that had not been able to set aside replacement funds. They were living on their capital and were getting in worse condition. The holding company puts the operating plant in good physical and financial condition and introduces proper accounting so that it stops living on principal. Mr. Beekman explained the financing of holding companies and their subsidiaries. The object is to get the money as cheaply as possible. Various methods are adopted to raise capital either through direct sale of securities of the subsidiary or their deposit as collateral security for the securities of the holding company. For instance, the New Orleans Railway & Light Company, a subsidiary, had to spend a large amount of money for improvements required by the city. The holding company guaranteed the notes, and these obligations were sold partly in this country but largely abroad. In 1913, in order to meet absolute capital requirements, the subsidiary companies of the American Cities Company and of the United Gas & Electric Corporation had to issue $14,000,000 of securities. These were to provide for the actual necessities of enlargement due to the development of the business. The financiers made scarcely anything out of the transaction. It will be found, said Mr. Beekman, that small profits, if any, have been made by public-utility-holding companies in the financing of the concerns subsidiary to them.

Mr. Beekman, continuing, said that the price of gas and of electrical energy has gone down steadily. Street-railway rates have not gone down, but the service has been extended. The rate of fare is so low on street railways now that it cannot be reduced further. Replying to a question as to the low-fare cities in Ohio, Mr. Beekman said that the operating officials in his organization feel that a day of reckoning for those properties is coming. Some of the combined operating companies furnishing different classes of utility service are losing on the street-railway business but gaining in the electric and gas departments. The street railways have to meet the labor problem and are unable to raise fares in order to overcome the effect of higher wages. Reliance has to be placed on the combination of the different classes of service.

In referring to different experiences with plants in small cities, Mr. Beekman said that local people start properties with the idea that they can make money. After disappointment they refuse to invest more capital. The additional capital then has to be secured outside. The holding company can guarantee the securities of the subsidiary company which has not good credit and raise capital in that way. The holding company makes its profit from the increase in the value of the equities represented by the stock.

So far as the actual operating companies are concerned, they are controlled by state statutes and commissions. The holding company has to go to the public in order to finance itself. The public has to pay a return on the securities of the local company, and it is the function of the holding company to find means of providing the necessary large amounts of capital. It is not so important that the holding company should be held to accountability. Companies have been accustomed for years to sell bonds at a discount without criticism, but it is held to be a crime to sell stock at a discount.

Securities of holding companies are sold to European investors who do not speculate but buy with the prospect of an enhancement in value. That process draws great amounts of capital to this country without placing any burden on the public. The cost of financing would be greater without the holding company. The local companies have poor credit and are unable to discount bills. Holding companies buy in enormous quantities at prices from 10 per cent to 15 per cent less than small local companies secure. They get the benefit of trade discounts. In addition, they are able to borrow money at lower rates. There is a serious danger in the bill as it stands.

Cost of Money for California Utilities

Some interesting testimony on the cost of money to California public utilities is found in the affidavit made by A. F. Hockenbeamer on March 2, 1914, in the case of the Pacific Gas & Electric Company vs. the City and County of San Francisco in the United States District Court for the Northern District of California, Second Division. Mr. Hockenbeamer has been connected with the Pacific Gas & Electric Company since Feb. 1, 1908, as comptroller, treasurer and vice-president, and previous to that time for three years was connected with N. W. Halsey & Company, bankers, New York.

Mr. Hockenbeamer says that the company is compelled under the law of the State to render satisfactory and adequate service and to extend its facilities to all residents within its territory who may be within 100 ft. of its main or distribution lines. The penalty for neglecting to do this within ten days after an application for service is $50, and $5 per day thereafter. The possible aggregate of such damages can be understood from the fact that during the calendar year 1913 the company connected 15,350 new customers to its distribution system within the city and county of San Francisco, and 28,452 to its entire distribution system. The capital expenditures required for such connections were, of course, not limited to the cost of connections

and meters, but the company from time to time was obliged to enlarge its entire plant. Other capital expenditures become necessary when the company is required by law to change the location of its street lines and various supply systems or to make other improvements. For various purposes the company has been obliged to spend during the past eight years more than $54,000,000 for capital purposes, and as a matter of self-preservation it must keep its system modern and efficient. For some years to come it will probably have to find between $5,000,000 and $10,000,000 new capital. It must also, according to the terms of its mortgages, secure money for its sinking fund payments to the extent at present of approximately $800,000 a year and later of $1,813,000 a year.

Mr. Hockenbeamer summarizes the statements in his affidavit as follows:

"1. That the law compels constant expansion of plaintiff's facilities and corresponding increase in its investment.

"2. That plaintiff must raise from $5,000,000 to $10,000,000 of new capital per annum for new construction, and additional large sums for the payment of maturing obligations and other purposes.

"3. That market quotations on bonds do not measure the cost to utilities of borrowed capital.

"4. That plaintiff's stockholders are entitled to a greater return on the value of their property than the mere cost to them of borrowed capital.

"5. That it has cost plaintiff from 6.1 per cent to 10.75 per cent per annum to borrow money on secured obligations, exclusive of necessary expenses.

"6. That in twenty-one months the Railroad Commission of California authorized the issuance and sale of more than $37,000,000 of secured obligations of California gas and electric corporations at prices making the cost to these utilities of the money so borrowed from 6 per cent to 10.75 per cent per annum.

"7. That plaintiff must obtain a large proportion of its new capital from stockholders.

"8. That the best price at which plaintiff was able to sell $3,000,000 of its stock was on an 8.6 per cent basis of a yield.

"9. That the Railroad Commission of California has authorized various gas and electric utilities to sell an aggregate of $3,327,500 par value of preferred stock on a basis of yield of 7.5 per cent, and $3,000,000 of common stock on a basis of yield of 7.74 per cent.

"10. That there must be a substantial margin of earnings in excess of interest and dividend requirements to make stocks and bonds salable and to provide for other necessary charges against net earnings.

"11. That the utilities of California must offer their stocks and bonds in competition with thousands of other investment securities and must make them to conform to the standards of safety demanded by investors.

"12. That California utilities cannot raise the required new capital in the home market owing to other demands and to the many other profitable avenues of investment open to such home capital.

"13. That capital in large amounts is safely employed in the business of banking under the national bank act at an average annual profit in excess of 9 per cent.

"14. That, owing to severe competition, capital employed in the electric light and power business in San Francisco is exposed to unusual hazard and uncertainty of return."

In his conclusions Mr. Hockenbeamer expresses the opinion that unless his company is able, and is permitted, to derive net profits from the operation of its business equivalent to at least 8½ per cent per annum upon the money invested or to be invested in its enterprise, it will be unable to obtain the additional capital necessary to carry on its business.

He is also of opinion that the capital employed by the company could not be persuaded to embark in its enterprise without the reasonable assurance of a return of at least 10 per cent per annum.

Arguments Against Municipalization of Washington Street Railways

Mr. Clarence P. King, president of the Washington Railway & Electric Company, and Mr. Thomas N. McCarter, president of the Public Service Corporation of New Jersey, testified before the District committee of the House of Representatives at Washington, D. C., on May 13, in regard to a bill introduced by Congressman Crosser, of Cleveland, providing for municipal ownership of the street railways in the District of Columbia.

Mr. King declared that the companies in the district operate directly under an act of Congress and that they have been developed under the authority of that body. Congress directed that horse-cars be abolished. The company experimented with cable, compressed-air and storage batteries before it finally introduced the underground-conduit system by which it is now operated. The present Washington Railway & Electric Company succeeded a former company which was unable to operate the street railways profitably and underwent reorganization.

Mr. King contended that in ordering the change in method of construction Congress gave practically a contract and franchise without limit. In any valuation of the property the history of the company from horse-car days would have to be taken into consideration.

Mr. McCarter, in introducing his discussion of the subject, said that he did not own a share of stock or any financial interest in either of the companies in the District. Although a lawyer by profession, he has been exclusively occupied for the last eleven years as president of the Public Service Corporation of New Jersey. He appeared before the committee because he conceived it to be his duty to give his views and utter a word of warning in regard to what he considered the dangerous experiment the members of the committee were considering.

Mr. McCarter said he would frankly state that his expert knowledge came from his connection with the company for the last eleven years and his practice at the bar for ten years previous, when his time was given largely to the representation of companies of the same character. Over and above that, however, Mr. McCarter declared that he was an American, that he thought he was a good citizen and that he has the welfare of his country at heart. Of course, the views of men are likely to be biased by their life activities, but he resented the idea that a public utility official could not be interested in the public welfare of his country.

Mr. McCarter's first thought regarding the situation is that the whole scheme of municipal ownership is un-American. It is not suited to the form of government devised by our forefathers and handed down for generations. It would mean bureaucracy galore. It would mean that the government would take on an enormous army of men and ultimate operation of the country by the government through this enormous army. The subsidiary companies of the Public Service Corporation of New Jersey have 12,000 employees and serve 2,000,000 of the 2,500,000 people in New Jersey. If the same proportion held good throughout the country, there would have to be added to existing government and municipal employees from 600,000 to 750,000 men.

A member of the committee said that the federal government now employs 471,000 people.

The law is, Mr. McCarter said, that there is a limitation on the power of the Legislature to alter or repeal a franchise even though the franchise contains a reservation of the right to alter, amend or repeal. The right to revoke the charter of a company might exist, but the franchise could be sold by the company or a receiver. If the legislating body failed to fix a definite time for duration of the contract it created, in the opinion of Mr. McCarter, a perpetual franchise. The public can protect itself through the rate-making power or by condemnation of the property. In the latter case, if the capitalization is not taken into account in the determination of the value, the only test is the fair value of the property devoted to the public use.

New Oldfield Bill on Patents

A bill designed to take the place of the original Oldfield patent bill has been introduced in the House of Representatives by Congressman William A. Oldfield, of Arkansas. It is a material change from the original bill and represents the result of the careful study which has been given to the subject since the introduction of the earlier measure. The bill, which was referred to the committee on patents, of which Representative Oldfield is chairman, is entitled "A bill to revise and amend the laws relating to patents." It provides that Section 4884 of the Revised Statutes shall be amended to read as follows:

"Every patent shall contain a short title or description of the invention or discovery correctly indicating its nature and design, and shall have annexed thereto and made a part thereof a copy of the specifications, claims and drawings of the application therefor, to which it shall refer for the particulars of the invention or discovery, and contain a grant to the patentee, his heirs or assigns, of the exclusive right to make, use and vend the invention or discovery throughout the United States and all territories and possessions under the jurisdiction thereof for the term of seventeen years. But every patent granted for an invention shall be so limited as to expire nineteen years from the date of the filing in this country of the application upon which the patent was granted, exclusive of the time actually consumed by the Patent Office or the courts in considering the application and, where the application has been involved in interference, of the actual time in which it has been so involved; and in no case shall the patent be in force more than seventeen years."

Section 4899 of the Revised Statutes would be amended to read as follows:

"Every person who purchases of the inventor or discoverer or, with his knowledge and consent, constructs any newly invented or discovered machine or other patented article prior to the application by the inventor or discoverer for a patent, or who sells or uses one so constructed, shall have the right to use, and vend to others to be used, the specific thing so made or purchased, without liability therefor. No person selling or otherwise disposing of any article manufactured under a patent shall have any greater right to prescribe, either by contract or otherwise, conditions limiting its subsequent disposition or use than if the article were not manufactured under a patent. No purchaser, lessee or licensee of a patented article shall be liable to an action for infringement of the patent because of any breach of the contract of sale, lease or license, or of any provision thereof. No person who obtains a license to use any patented art or process, or to make, use and sell any patented article, shall be liable to an action for infringement of the patent because of a breach of such license or of any provision thereof."

To the court of the district where the owner of a patent or of any interest therein is an inhabitant or may be found jurisdiction is given to compel the granting of a license under such patent under the circumstances hereinafter set forth.

The person applying for the license shall file a bill in equity setting forth briefly the facts and circumstances, and the court shall thereupon hear the person applying for the license and the owner of the patent. If the applicant shall prove to the satisfaction of the court that the patented invention is being withheld or suppressed by the owner of the patent, or those claiming under him, for the purpose or with the result of preventing any other person from using the patented process, or making, using and selling the patented article in the United States in competition with another article or process, patented or unpatented, used, or made, used and sold, in the United States by the owner of the patent or those claiming under him or authorized by him, and also prove that the application for the patent was filed in this country more than three years prior to the filing of the bill in equity, the court shall order the owner of the patent to grant a license to the applicant in such form and upon such terms as to duration of license, amount of royalty, security for payment thereof and otherwise as the court, having regard to the nature of the invention and the circumstances of the case deems just. It is provided, however, that nothing shall be construed to authorize the court to compel the granting of a license by the original inventor who has not obligated himself or empowered another person to suppress or withhold the invention.

From the order of the district court granting or refusing such license appeal may be taken by the party aggrieved to the circuit court of appeals in the same manner and form as in other cases arising under the patent laws. The provisions of this section, however, shall not apply to any patent granted prior to the passage of this act.

The bill provides further that every applicant for a patent or for the reissue of a patent, and every owner of a patent or of any interest therein, who is not domiciled within the United States shall within three months next after the filing of his application or of the acquirement of his interest in the patent, or after the passage of this act, designate by a notice in writing filed in the Patent Office some person residing in the United States upon whom process or notice of proceedings brought under the provisions of this act or other laws of the United States may be served with the same force and effect as served upon the person of applicant or of the owner of the patent. No such owner of a patent or of any interest therein shall be entitled to institute an action of infringement until after compliance with this section or to recover damages for infringing acts prior to compliance therewith.

In the act, unless the context otherwise requires, "person" shall include firms, corporations or association existing under the laws of the United States, any territory or possession, any state or any foreign country. "Patent" means patent granted by the United States, whether for an art or process or article, machine, manufacture or composition of matter. "Patented article" includes patented machine, manufacture or composition of matter.

The bill says the act shall take effect Jan. 1, 1915.

A preliminary meeting of the committee on patents was called for May 13, when it was proposed to arrange for a series of hearings on the bill. On account of the absence of several members of the committee, however, the meeting was postponed.

Legal Aspects of Regulation

Mr. Charles F. Mathewson, of New York, made an address on "Some Legal Aspects of the Regulation of Public Service Corporations" before the Finance Forum of the West Side Branch of the Young Men's Christian Association, New York, on May 11. In introducing his subject Mr. Mathewson spoke of the importance of regulation to corporations and consumers. He added that the most essential consideration to customers is efficiency of service, and any mistaken theory or imposition which compels a public service corporation to sacrifice efficiency to lower rates is, and will sooner or later be recognized to be, a greater misfortune to the public than to the corporation.

Rate-making is, of all manifestations, Mr. Mathewson declared, the most serious and common aspect to public service corporations of the special regulatory power of the state. If a legislative act fixing rates is passed in the usual manner, it is possible that it does justice, but if it does so, it is usually due to Providence only; and such legislation, where a commission is in existence, is vicious to the last degree in principle and usually in result.

On the other hand, a commission, said Mr. Mathewson, may proceed at leisure. It has opportunity for complete examination of all essential facts. Its members are in office for a term of substantial length, so that they should be more independent of popular disfavor or popular acclaim than are legislatures.

The first matter to be considered is the value of the property employed. It has taken many years and multitudes of decisions to determine what elements of property shall be included in the total valuation, the basis upon which they shall be valued, and the amount (if any) which shall be deducted therefrom for depreciation to reach the ultimate base upon which the return is computed. So, too, what constitutes a fair rate of return has been the subject of innumerable decisions, and even now no uniform rate has been or can be settled upon as applicable to every case. It is necessary further to distinguish between a rate of return which may be barely non-confiscatory and therefore constitutional and a rate of return which is commercially just and fair.

Ascertainment of the reproductive value of the physical property involves elements of information and judgment which require engineering skill of high degree. It is said that the physical valuation of the railways of the United States recently authorized by Congress will cover five years and cost $10,000,000. Mr. Mathewson expressed the view that it will cover twice that period and cost more than twice that sum to the national government alone, to say nothing of the incidental cost to the railways, and that after the valuation is completed it will then be so far behind the times that it will in hardly any case represent the full value or present value of the property, and in the case of most railways it will never be of any value at all except statistically.

Mr. Mathewson then outlined the different items and allowances included in a physical valuation. The intangible property may be, and often is, divided into two classes—cost of "organization and development" and cost of "going" or "going concern" value. It is not surprising that the development and organization work may represent a cost equal to 20 per cent or more of the entire cost of the physical property itself.

In commenting on the recent decision of the Court of Appeals of New York in the Kings County Lighting Company case the speaker disagreed with the expressions of the justice who wrote the opinion. The opinion defined "going value" for "rate purposes" as "the amount equal to the deficiency of net earnings below a fair return on the actual investment" due to the expenditures reasonably incurred in the development of the business and property of the company, in addition to the value of the physical property. Mr. Mathewson believed it to be the sound doctrine that such expenditure represents the value of the "going-concern" development whether there is a deficiency in net earnings by reason of such expenditure or not. The language of the justice, literally read, would indicate that there could be no "going concern" value in the case of a corporation which earned a fair return on the investment from the beginning; and while the discussion may be academic because there is rarely found such a corporation, yet his proposition as quoted is believed to be unsound.

Mr. Mathewson also touched on franchise value. Quoting various rates of return, the speaker declared his belief that it follows that even in the city of New York 8 per cent is not more than a fair return for public service corporations; and in Connecticut, New Jersey, Wisconsin and other states similar views have been expressed respecting corporations there operating.

Whether "accrued depreciation," so called, should be deducted from the cost of reproduction of the company's property, and a return allowed only on the balance of the investment, was discussed by the speaker. "Accrued depreciation" as used does not mean deterioration, which should already have been made good by repairs or replacements; it means or represents expired life of apparatus still operating as efficiently as when new. Thus a gas retort half of whose estimated period of life has expired is producing just as much gas at just as low a cost as when it was installed; but it is claimed by some authorities, including the New York Public Service Commission, First District, that such retort should nevertheless be included in the valuation of the company's property in a rate case at only 50 per cent of its cost value.

This theory was recently accepted by the Appellate Division of the Supreme Court in New York State in the Kings County Lighting case. It has never been passed upon by the Court of Appeals; it is in direct conflict with what Mr. Mathewson understood to be the holdings of commissions in other states, such as Connecticut, New Jersey and Wisconsin, and he believed that it is thoroughly unsound and will ultimately be so held in all courts. It has not been adopted by the Public Service Commission of the Second District, but is wholly contrary to the views of the engineer of the Public Service Commission of that district as expressed by him in the Westchester Lighting Company case, and also to the views of the engineer of the Public Service Commission of the First District, who acted for it in the Kings County Lighting case, as expressed by him to Mr. Mathewson.

It is true that the Supreme Court of the United States, and some other courts following it, have expressed in general terms the view that some depreciation is deductible in a rate case; but it is fair to say that the subject never has been fully or adequately presented in the Supreme Court, and that that court has never declared that "theoretical depreciation" should be deducted, representing merely expired life of still efficient apparatus, where it is a question merely of rates for service between a company and consumers. The motto should be "100 per cent of efficiency and 100 per cent of return." Nothing else is or ought to be satisfactory either to the company or to consumers.

In conclusion, the speaker said that if allowances for doubt are to be made, it is far better for the community (to say nothing of the corporation) to err on the side of liberality than in the other direction.

Public Service Commission News

California Commission

The Railroad Commission of California and representatives of large gas and electric companies have joined in an application to the State Supreme Court for a rehearing of the case in which the commission denied permission to the Oro Electric Corporation to compete in Stockton with the Western States Gas & Electric Company. The petition for a rehearing says in part: "We take the position that if rates are to be cut down by the commission and regulation carried to the point of fixing a certain rate of revenue, then the regulated companies must be protected in their fields from competition. Competition and regulation do not go together. Either competition must be allowed to take its course in determining rates or, if rates are to be fixed by regulation, then the power that regulates must protect from competition. If competition is allowed, there should be no regulation, and if regulation is enforced then competition should be restricted. This is an important economic principle.

"It has been said that the California Railroad Commission has taken advanced ground in seeking to protect regulated companies from unnecessary competition, but as a matter of fact the older commissions in New York, New Jersey and other states have taken much more pronounced positions in this regard, and they have been followed by the newer commissions of Idaho, Montana and Arizona."

New York Commissions

The Department of Efficiency and Economy of New York State has started an investigation of the Public Service Commission, Second District. It is stated that the investigation arises from the fact that the commission has not reopened hearings in the case of the Canadian-American Power Corporation, which was authorized to place a capital value on a contract for power with one of the Niagara Falls companies. Complaints against the commission were lodged with the Department of Efficiency and Economy. Chairman Van Santvoord made a statement saying that the failure of the commission to act on the complaint is due to the fact that three of the members, including himself, took office after the approval of the application of the company and that time had not been allowed for the new members to become familiar with the case.

"If I could seriously believe," Mr. Van Santvoord said, "that the statement intends to convey the idea that an investigation of the commission had been undertaken and would be pressed because the commission declined to comply with the demands of the Department of Efficiency and Economy to investigate certain complaints or to decide a pending application, I would quite as seriously suggest that such action or threat might properly be taken before a grand jury."

Indiana Commission

Governor Ralston of Indiana seems determined that the Public Service Commission or some part of it—probably three members—shall continue to serve as an arbitration board to mediate between the Indianapolis Traction & Terminal Company and its employees. The commission struggled through three months of hearings on the original strike situation and handed down an award in which an arbitration board, to be appointed by judges of certain courts in Indianapolis, was to mediate during the three years of the strike settlement agreement.

The judges of the courts declined to serve as the appointive power for the arbitration board, because appeals from that board might reach their courts. Since that declination labor troubles have been threatening again. Throughout practically every step of the mediation attempts since the decision was handed down, one side or the other has suggested that the commission serve as the new arbitration board. Many of the employees are opposed to such service by the commission, and already several questions under the award of the commission have directly conflicted with duties of the commission under the act of the Legislature creating the body. Regardless of this fact, the latest move toward a settlement of the labor difficulty—entered into by the Governor and Mr. A. L. Faulkner, of the United States Bureau of Labor—provides that three members of the commission, Messrs. Thomas Duncan, Charles A. Edwards and John F. McClure, shall serve as the special arbitration board.

Missouri Commission

The first annual report of the Missouri Public Service Commission has been issued. It covers the period of eight and one-half months ended Dec. 31, 1913. The report says that an appraisal of the property of the Kirksville Light, Power & Ice Company has been completed. Preparations are being made for the appraisal of the properties of four steam railroads, one electric railway, two electric utilities and two telephone utilities.

In reference to the department of statistics and accounts, the report said in part: "Appreciation of capital cannot be recognized as an offset for depreciation. Appreciation should not be considered under any circumstances unless actual sale has been made and there is a real profit, in which case it can rightly be classed only as a profit on sale of capital. If, however, there has been a transfer for a more expensive property, the appreciated value of the new property may be taken into account as a capital surplus item."

The gas, electric, heat and water department has been engaged for some time in forming a tentative set of rules and regulations applicable to gas, electric and water service within the State. These rules will involve ultimately considerable addition to the working force of the department as well as the establishment of a laboratory equipped with suitable facilities and standards for the various tests which will be conducted. It is probable that the public service commission law will be changed so that meters will be tested by the commission only on request of the consumer for a reasonable fee or on its own volition where that is deemed desirable. It is probable that arrangements may be made with the State University at Columbia to do all of the testing for the commission in connection with standards of service until the commission is able to establish a suitable laboratory of its own at Jefferson City.

The report refers to the clause in the law stating that no electric meters shall be put into service the type of which has not been approved by the commission. Commenting on this clause, the report says that it is questionable whether the advantage gained by the consumer of electric energy will compensate for the extra expense devolving on the commission through the enforcement of this regulation. At any rate all meters will be tested before installation and will be subjected to periodic tests thereafter. Individual meters or a number of a certain type of meters whose test record shows a marked tendency to vary in accuracy of measurement, regardless of the ordinary adjustment or repairs, will subject that particular meter or type to permanent rejection. A systematic inspection will be made of all the gas, electric, heating and water plants at as early a date as possible, together with the transmission and distribution systems in connection therewith.

Current News Notes

Forest Products Exposition.—At the Forest Products Exposition to be held at the Grand Central Palace, New York, from May 21 to 30 there will be exhibited by the Northern White Cedar Association some telephone poles of Northern white cedar that have been in actual service for fifty years, ties used for twenty-nine years and some fine quality posts. The Northern White Cedar Association was formerly the Northwestern Cedarmen's Association. The name was recently changed in order to correspond with the name given by the United States Forest Service to the cedar timber growing in the States of Michigan, Wisconsin and Minnesota, from which the products of the members of the association are manufactured. Mr. N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn., is secretary of the association.

* * *

Outside Engineer to Report on Affairs of Sanitary District of Chicago.—Following the dispute among the trustees of the Sanitary District of Chicago and some of the aldermen of the city in relation to the cost of producing the hydroelectric energy supplied by the Sanitary District for Chicago street lighting, the Board of Trustees of the Sanitary District, after a recent stormy debate, adopted a resolution recommending the employment of Mr. Gardner S. Williams, a consulting engineer, of Ann Arbor, Mich., to investigate all facts and questions arising in connection with the cost and operation of the Sanitary District's hydroelectric plant and electrical development, together with recommendations relating to the sale to the best advantage of the energy generated. The total cost of the investigation is not to exceed $100 a day.

* * *

St. Joseph Electric-Service Company Gives City a "Slogan" Sign.—On April 17 the St. Joseph (Mo.) Railway, Light, Heat & Power Company, one of the Doherty properties, presented to the city a large and handsome "slogan" electric sign. This sign is placed on the twelve-story Corby-Forsee Building and bears the legend "St. Joseph, the City Worth While." Before the exercises marking the presentation of the sign to the city there was a night parade. The streets were illuminated by festoons of red, white and blue lamps, and a temporary trolley wire stretched over the line of march was utilized to supply electricity to the floats. Every float entered was decorated with electric lamps, some being embellished with as many as 300 or 400. In addition to the floats nearly every electric pleasure automobile in St. Joseph was in the parade. These cars were decorated with miniature lamps and flowers.

* * *

Examination for Expert Radio Aid.—An examination for expert radio aid is announced by the United States Civil Service Commission for June 17, 1914. From the register of eligibles certification will be made to fill a vacancy in the Navy Yard, New York, at $6 per day. The duties of the appointee to this position will be to direct and assist in the laboratory standardization tests of all circuits, instruments and apparatus relating to radio-signaling and in the development of special apparatus and methods of radio-signaling suited to special conditions and of new forms of sending and receiving circuits, to inspect the various radio stations, and to carry out such work as may be necessary for the development of radio apparatus. Those interested in taking this examination should write to the United States Civil Service Commission, Washington, D. C., and ask for Form 1312, stating the name of this examination.

SOCIETY MEETINGS

Governor Cox Now a Jovian.—At the rejuvenation of the Jovian Order in Dayton, Ohio, on May 9, a class of thirty-eight candidates was initiated under the direction of Statesman Thomas F. Kelly. Among the newly made Jovians were Governor James M. Cox of Ohio and City Manager H. M. Waite of Dayton.

* * *

Cleveland Rejuvenation.—Elaborate preparations are under way for the rejuvenation and joviation of the Jovian Order to be held in Cleveland on May 26 during the Cleveland Electrical Exposition. The Cleveland Electrical League, Jovian Chapter, has invited the Jovian leagues of a number of other cities to be represented, and a large gathering is anticipated.

* * *

Detroit-Ann Arbor Section, A. I. E. E.—At a meeting of the Detroit-Ann Arbor Section of the A. I. E. E. on May 8 at Ann Arbor, Mich., Mr. H. L. Wallau, electrical engineer of the Cleveland Electric Illuminating Company, Cleveland, Ohio, read a paper on "Factors Entering Into the Cost of a Kilowatt-Hour." The general discussion was led by Mr. W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, Chicago. Prof. H. H. Higbee, of the electrical engineering department of the University of Michigan, was in charge of the arrangements for this meeting.

* * *

Chicago Rejuvenation.—A successful rejuvenation and joviation of the Jovian Order was held in Chicago on May 11 under the direction of Statesman Homer E. Niesz. Seventy candidates were initiated, the total attendance being about 250. Brief speeches were made by Mr. W. W. Winship, of Philadelphia, statesman-at-large; Mr. Leonard Fitzgerald, of Gary, Ind., statesman, and others. The initiation is said to have been the most impressive ever held in Chicago, the work of the degree team and the scenery and lighting effects being especially good. The degree team was made up as follows: Jupiter, Roy E. Schaulin; Neptune, W. E. Finlay; Pluto, George C. Richards; Vulcan, O. J. Kaberna; Mars, John Foster; Hercules, O. H. Johnson; Mercury, Walter Bischoff; Apollo, R. M. Prior; Avrenim, A. J. Selzer.

* * *

Dallas Electric Club.—At some of the recent weekly luncheons of the Dallas (Tex.) Electric Club, which meets each Friday noon at the Oriental Hotel, Dallas, the attendance has been seventy-five and more. A number of prominent laymen have addressed the club, a recent speaker being Mr. Royal A. Harris, president of the American Exchange National Bank, who talked on the federal reserve act as it applies to the establishment of a reserve center at Dallas. The Dallas Electric Club is a comparatively new organization and has as its officers Mr. W. J. Drury, Western Electric Company, president; Mr. F. R. Slater, Texas Power & Light Company, vice-president; Mr. Charles W. Davis, Westinghouse Electric & Manufacturing Company, vice-president; Mr. E. S. Marshall, Dallas Electric Light & Power Company, vice-president, and Mr. H. S. Cooper, Southwestern Gas & Electrical Association, secretary and treasurer. Mr. R. D. Cummings, Western Electric Company, is chairman of the entertainment committee; Mr. L. V. Nogueira, Electric Appliance Company, heads the entertainment committee; Mr. Hartwell Jalonick, Texas Power & Light Company, is chairman of the educational committee, and Mr. F. L. Booth, Texas Power & Light Company, is chairman of the commercial committee. The club has 150 members.

Unmarketable Coal Used for Generating Electricity—II

Switch and bus layout of the Lehigh Navigation Electric Company's station at Hauto, Pa.—Use of 110,000-volt reactance-type switches—Features of the transmission-line construction

THE equipment of the Hauto station is arranged on the unit system; that is, one generator, one set of transformers and one outgoing feeder line are normally to be operated as a unit. Power is generated at 11,000 volts, twenty-five cycles, by three 12,500-kw General Electric turbo-generators. Three sets of General Electric transformers, one for each generator, step the voltage up from 11,000 volts to 110,000 volts. The energy from each machine is fed through reactors in the basement to generator buses from which two circuits tap off—one feeding its individual transformer set and the other energizing an 11,000-volt loop bus. From the 110,000-volt side of the transformers circuits lead to transformer buses feeding outgoing lines and the main 110,000-volt bus, which will be connected in a loop the same as the lower-voltage bus when more units are added. The 11,000-volt bus also feeds two auxiliary buses supplying energy to 11,000-volt transmission circuits in the station and adjacent territory. The ultimate plan contemplates one 110,000-volt outgoing feeder for each set of transformers, but in the present installation there are only two. A 110,000-volt transfer bus is arranged so that any outgoing feeder may be connected to any set of transformers, or two or more feeders may be connected in multiple to one or more sets of transformers.

The generators are connected in multiple by means of the 11,000-volt ring bus equipped with sectionalizing switches. Two auxiliary 11,000-volt buses are provided for supplying energy to auxiliary motor circuits in the power house and in the mines, breakers and washeries of the Lehigh Coal & Navigation Company.

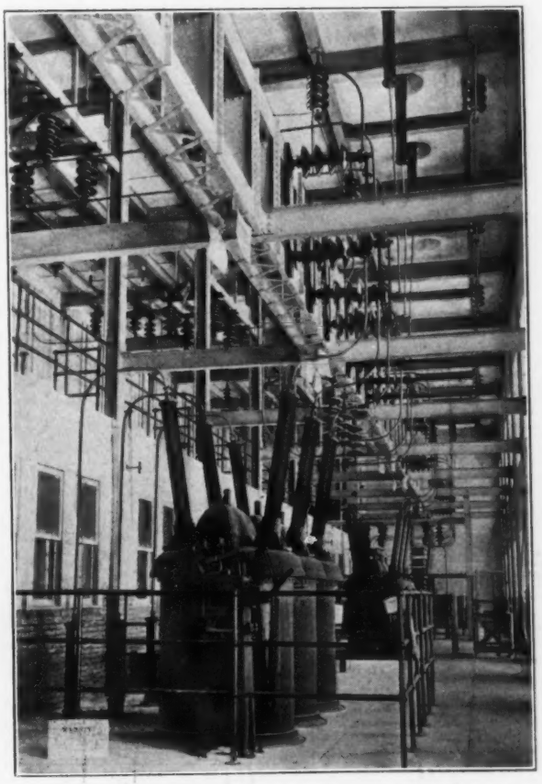


FIG. 11—HIGH-TENSION-EQUIPMENT OIL SWITCHES

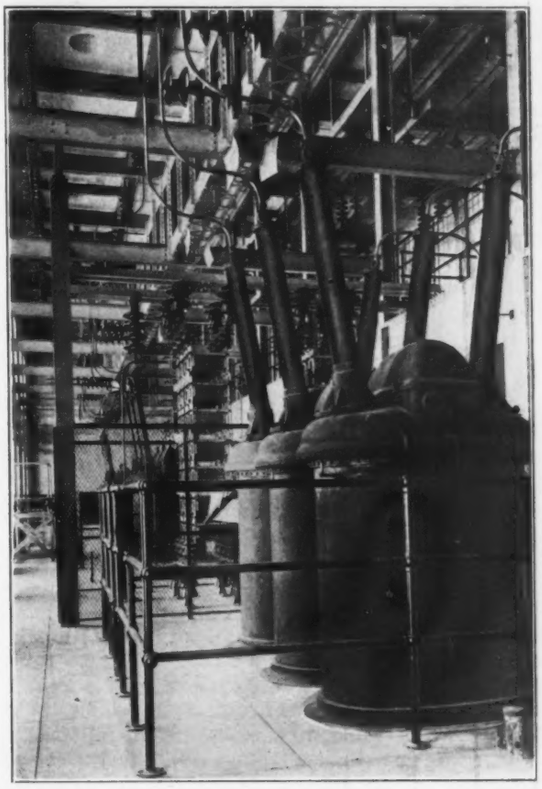


FIG. 12—110,000-VOLT REACTANCE-TYPE OIL SWITCHES AND NEUTRAL RESISTANCE TO GROUND

Along the north side of the engine room are three galleries containing the transformer and switching outfit. On the first floor, which is divided into two compartments by a fireproof partition, are the generator field rheostats, the low-tension buses and the transformers. On the floor above are the 11,000-volt buses and switches, the 110,000-volt oil-switches and the neutral ground resistor. The 11,000-volt outgoing circuits leave the building at the second-gallery floor level. Above the space containing the 11,000-volt switches is a compartment which will be devoted to high-tension bus-sectionalizing switches when the generating equipment is increased. On the same floor above the high-tension oil switches is the 110,000-volt bus structure. The outgoing high-tension circuits pass through roof bushings to choke coils suspended from insulators on a structural-steel framework on the roof.

All high-tension conductors are made of brass tubing, which is supported on porcelain insulators at least 3 ft. away from every part of the building except at points where it passes through the floors and roof. At

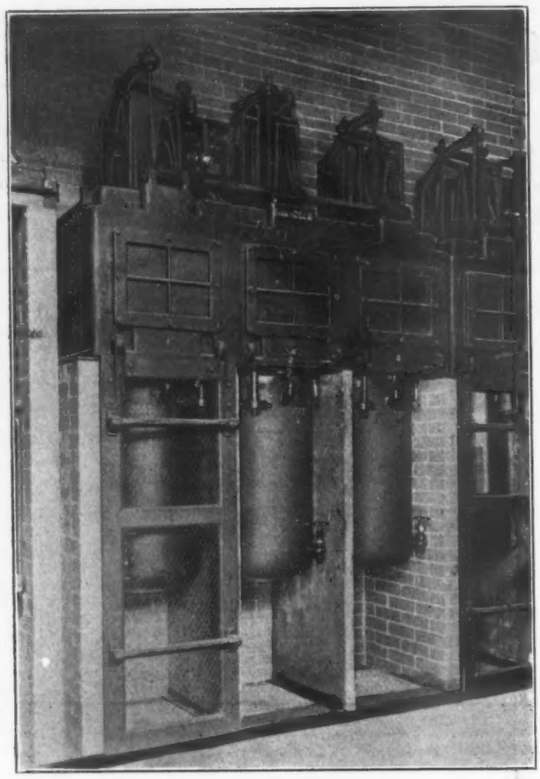


FIG. 13—22,000-VOLT REACTANCE-TYPE SWITCHES

these points the conductors are inclosed in special bushings.

The generators have 6 per cent internal reactance, which together with that in the leads limits the short-circuit current to ten times the normal value. No bus-tie or feeder reactors are employed in the station. One of the features of the installation is the use of 110,000-volt oil switches containing reactance to limit the current surges due to switching. Similarly equipped switches are also employed in the 11,000-volt circuits. All of the oil switches, with the exception of those connecting the generators with the main 11,000-volt bus, are of the automatic type. The reactor-type switches are used in the generator leads, on both sides of the transformers and between the 11,000-volt bus and the auxiliary buses.

The 110,000-volt reactor-type oil switches have an outward appearance similar to an ordinary single-phase

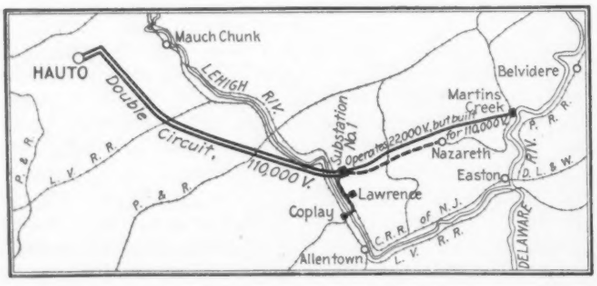


FIG. 14—MAP OF DISTRICT SHOWING TRANSMISSION LINES

high-tension switch, but their internal construction and operating mechanism are different. Each casing contains a main and an auxiliary switch, the latter being connected in series with a reactor across the main switch. The auxiliary switch closes before the main switch does, allowing the current to rise gradually through the reactor. On opening the switch the main contacts separate first and the reactor reduces the current enough to leave little possibility of a line surge when auxiliary contact opens. The contact rods are mechanically connected by an ingenious arrangement of levers and gears which allows a definite interval of time to elapse between the operation of the two switches. The three units composing one of the three-phase switching outfits are operated by one motor, which is geared to a shaft extending along the back of the oil switches. All of the contact rods, therefore, move simultaneously, and there is no possibility of one unit operating and not the other. The reactor is supported in the top of the case. The 11,000-volt switches operate on the same principle, but the reactor coil is immersed in oil.

The main 110,000-volt bus, which is a loop, is provided with sectionalizing switches which permit of operating all of the generators in parallel or separately, as each machine has its own bank of transformers and feeders.

Transformers

A bank of three 3350-kva oil-insulated water-cooled transformers is provided for each of the generators, to step the voltage up to 110,000 volts. An extra unit is installed to serve as a spare. The primary windings are connected in delta and the secondaries in star, while the high-tension neutral of each bank is connected through an electrically operated switch to a common neutral bus which is grounded through a resistor of 127 ohms resistance. The neutral of one of the banks of transformers being grounded, all except one of the transformer neutral switches are kept open by interlocking the neutral switches. The transformers are installed in fireproof compartments and are separated by walls of similar material from the low-tension busbars on the same floor.

Along the outside wall of the transformer compartment is a transfer-table track on which cars can be

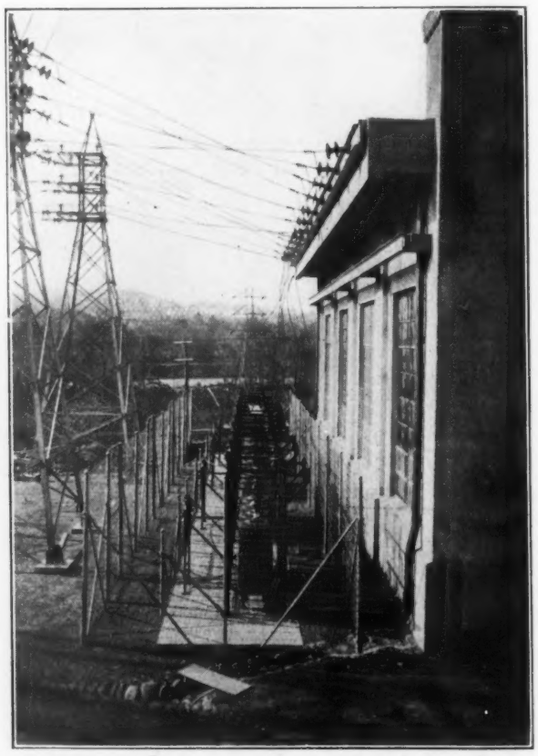


FIG. 15—SUBSTATION LINES AND LIGHTNING ARRESTERS

operated to facilitate the removal and installation of transformers.

Other Equipment in the Station

Three exciters are installed in the station. Two of them are 300-kw turbo-generator units developing 250 volts each, while the third is a 250-kw motor-generator set driven from 550-volt transformers. All the exciters are equipped with slip rings, which permit of connecting a neutral for three-wire emergency lighting. Energy for testing, lighting and driving the boiler-blower motors and the motor-generator exciter is supplied from two auxiliary buses which are energized by transformers connected to the 11,000-volt bus through automatic oil switches. A special motor-generator set is also installed to charge the 125-volt storage battery operating the switching apparatus.

A Nicholson arc suppressor will soon be installed in the station, which will, in case there is a short-circuit on any one of the lines, automatically ground that line through a fuse long enough to reduce the voltage and thereby extinguish the arc. If the short-circuit persists in recurring, new fuses are successively brought into service until eight have been blown, and then the overload relays will open.

Outdoor Apparatus

Installed outside the station are the electrolytic and horn-gap lightning arresters and the towers supporting the outgoing lines. Separate dead-end towers are erected for the 11,000-volt and 110,000-volt transmission circuits, the lightning-arrester equipment being installed at the base of each. The low-tension tower is situated nearest the station and is designed to support twelve conductors, six being arranged in a vertical plane on each side of the center line. The 110,000-volt circuits which leave the building at the roof pass over the low-tension tower and join the bridges supported by the high-tension towers. From this point two 110,000-volt circuits now extend to a substation at Siegfried, Pa., about 26 miles away. Two 11,000-volt lines also extend to Lansford, Pa.

Substation Equipment

The substation at Siegfried contains four 3350-kva, 110,000/22,000-volt transformers, one of which is held as a spare. They are connected in delta on both sides, and their primary coils are provided with five taps which may be used in compensating for line drop when the voltage falls below 110,000 volts. Reactor-type oil switches are also employed.

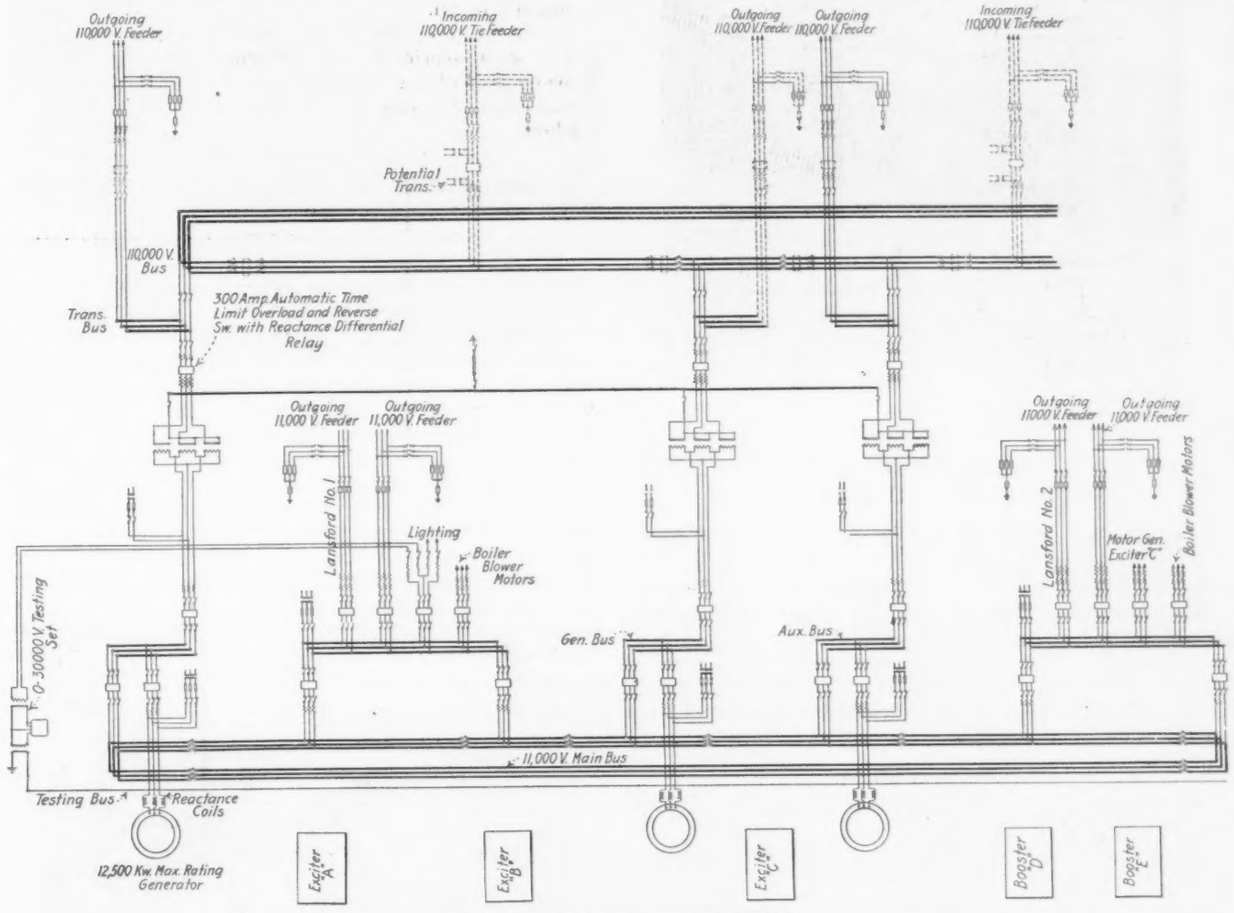


FIG. 16—GENERAL BUS LAYOUT

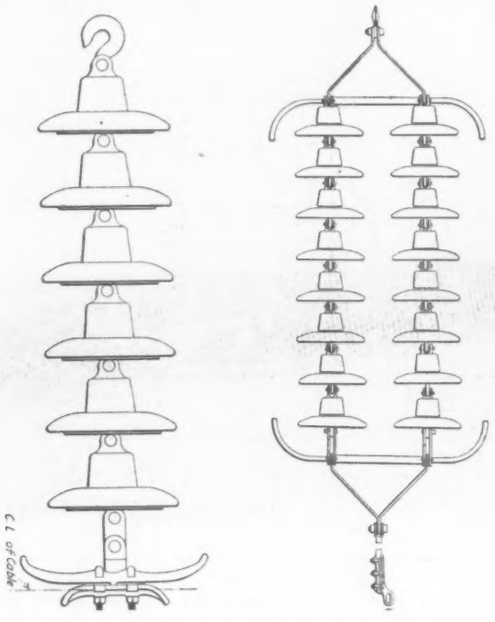
Energy Transmission

Energy is transmitted at twenty-five cycles from the Hauto station over a double-circuit 110,000-volt transmission line to a substation at Siegfried, Pa., from which two double-circuit lines extend to Martin's Creek and Coplay, Pa. Both of the latter operate at 22,000 volts, but the one going to Martin's Creek is designed for 110,000-volt operation and will transmit that voltage as soon as the line is extended sufficiently to warrant it. Two 11,000-volt lines run to Lansford, Pa., where 3200 kw in direct-current coal-mine equipment will be installed to supplement the 1800 kw in motors already used.

The Lawrence Portland Cement Company is situated just south of the substation at Siegfried and is supplied with energy at 22,000 volts. About 1200 kw in

equipment is installed now, but 3500 kw is contracted for, and that load will be supplied when the remainder of the equipment is installed. The voltage is stepped down to 2200 volts to operate the motors.

About 1000 kw is required at Coplay to supply the Coplay Cement Company, which operates with direct current. Rotary converters are installed there to deliver this form of energy.



FIGS. 17 AND 18—SUSPENSION AND DEAD-END INSULATORS EQUIPPED WITH ARCING HORNS

At Martin's Creek is the Alpha Portland Cement Company, which will eventually have 3500 kw in direct-current motors fed from a rotary-converter installation. Equipment totaling 1200 kw is already installed.

Along the line leading to Martin's Creek are rich coal fields which offer extensive opportunities for electrification. For this reason the electric-service company contemplates tapping the Siegfried-Martin's Creek line near Nazareth to supply service in that vicinity.

Line Construction

Double-circuit transmission lines are employed over the entire Lehigh Navigation Electric Company's system to insure uninterrupted service. Each circuit is designed to carry the entire load on the line in case one circuit has to be repaired or is temporarily disabled.

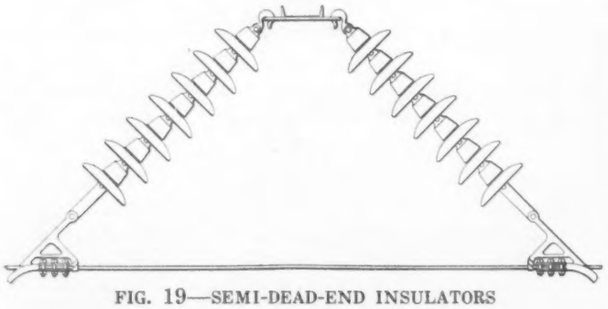


FIG. 19—SEMI-DEAD-END INSULATORS

The 110,000-volt circuits consisting of three stranded-copper conductors 0.625 in. in diameter are supported by six 10-in. disk porcelain suspension-type insulators on steel towers. Three conductors are arranged 10 ft. apart in a vertical plane about 9 ft. on each side of the center line of the tower, the lower conductor never being less than 22 ft. above the ground. The towers are 78 ft. 6 in. high and are spaced about 600 ft. apart. Two 0.375-in. galvanized-steel cables are run along the tops of the towers to protect the line conductors from lightning disturbances.

Special precautions have been taken to make the transmission lines as rugged as possible. Anchor towers of exceptional strength are placed at every turn in the line, and where the line is straight at intervals of about one-half mile. The footings are provided with concrete foundations to give a substantial base and prevent uplift, and the steel work is galvanized and painted with asphalt where it enters the ground.

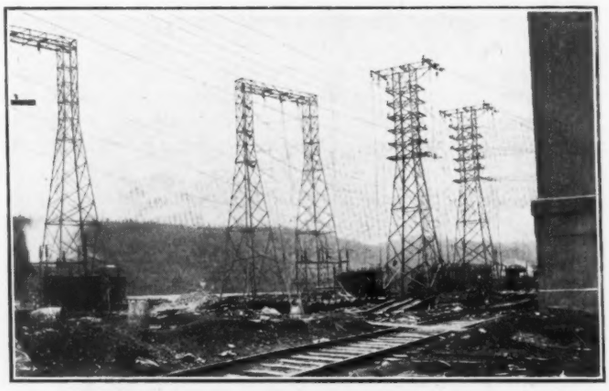


FIG. 20—110,000-VOLT AND 22,000-VOLT OUTGOING LINES

At the anchor towers each conductor is fastened to two sets of eight-disk dead-end insulators joined in multiple to reduce the mechanical strain on the porcelain. From the observation of other lines operating where lightning is prevalent it was noticed that a line surge caused by lightning has a tendency to flash over at dead-end insulators in its effort to go to ground. In doing so the insulators are sometimes punctured or wrecked, so to prevent such trouble on this line arcing horns have been installed to take the brunt of the discharge.

The end units of the dead-end insulators are attached to a metal rod electrically connected to the line conductor and bent in an arc at each end to form a discharge point for flash-overs. The vertical-type suspension insulators are also equipped with similar arcing horns.

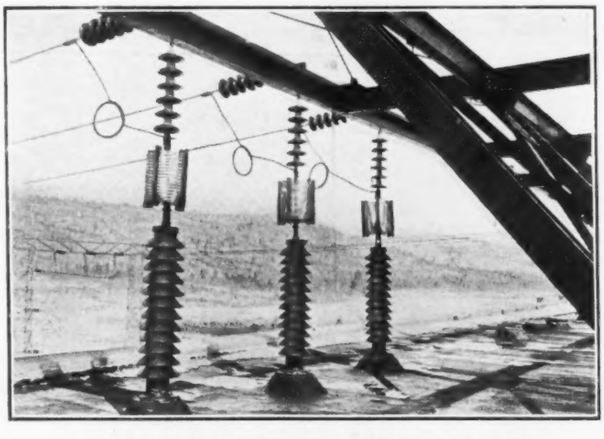


FIG. 21—ROOF BUSHINGS AND CHOKE COILS

To minimize the sag of conductors when they become loaded with ice or sleet, specially arranged insulators are employed on every third tower to support all except

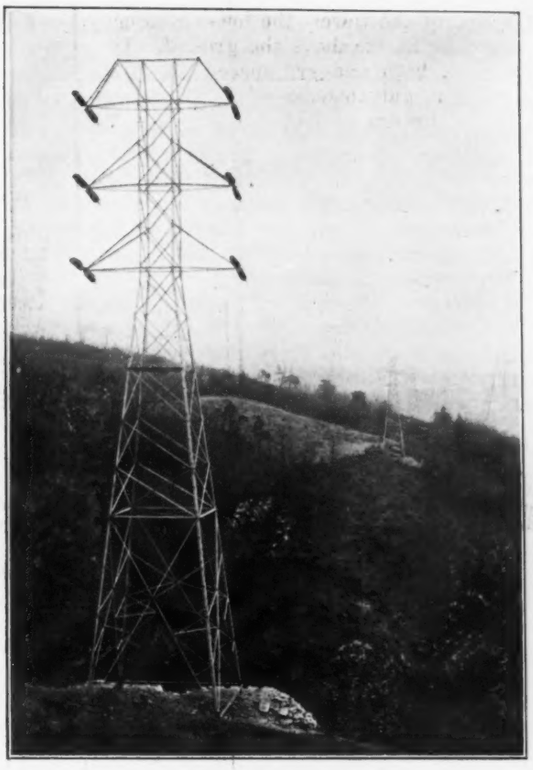


FIG. 22—ANCHOR TOWER

the lowest conductors. Two sets of suspension insulators are hung at the end of each cross-arm with their lower ends separated to form an isosceles triangle having the conductor as the base. The center lines of the insulators are at right angles to each other so that more than the normal tension in the conductors will deflect the insulators through only a small angle. The advantage in using this arrangement is that the conductor continues in its general direction in passing by the insulators and does not have to be connected with the adjoining span by a jumper, as is done when a dead-end insulator is employed on an anchor tower.

A 100-ft. right-of-way has been provided for the

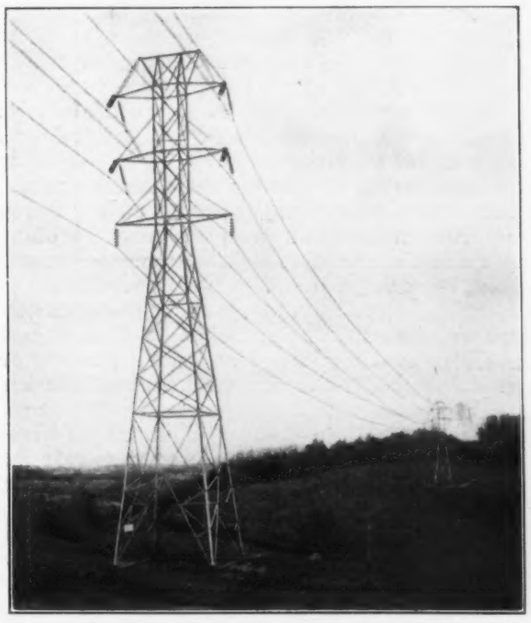


FIG. 23—SEMI-ANCHOR TOWER

110,000-volt and 22,000-volt transmission lines, the towers being installed at one side of the center line in order that another pole line may be erected on the same

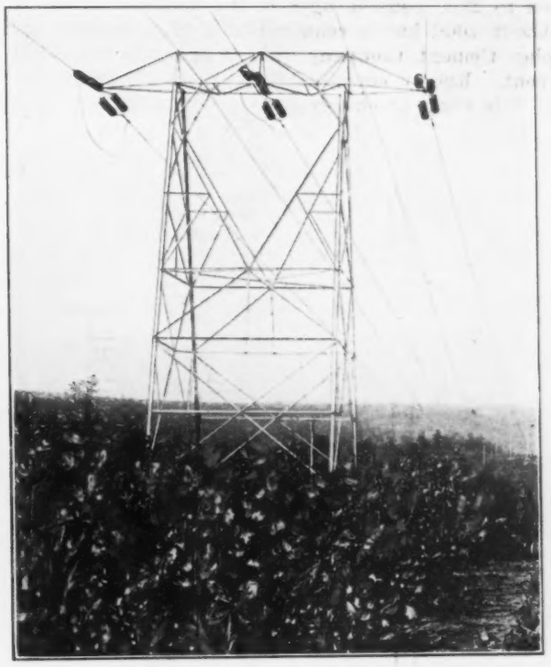


FIG. 24—SPECIAL TOWER OVER COAL OUTCROP

right-of-way when the service becomes so extensive as to warrant this being done.

Telephone System

A private-telephone circuit parallels both the high-tension and the low-tension lines. No. 6 copper wires are used and are supported on tower cross-braces. As

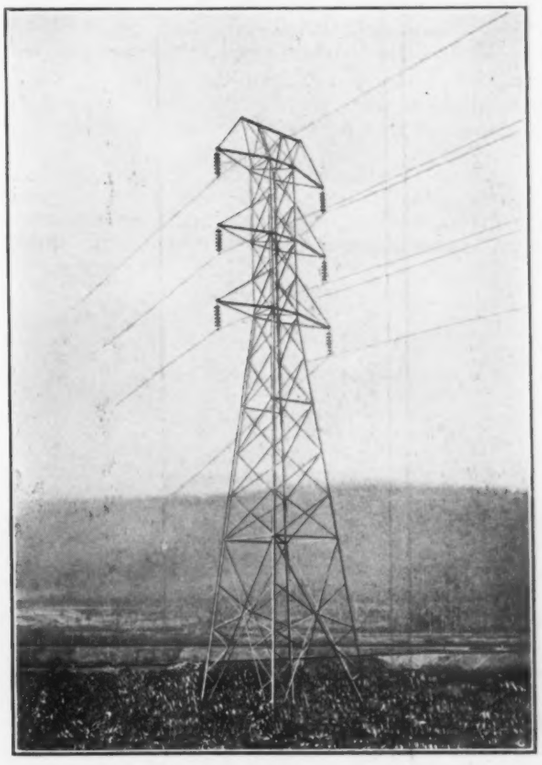


FIG. 25—TOWER WITH VERTICAL SUSPENSION INSULATORS

the spans are exceedingly long for this size of wire, wooden poles are installed at mid-spans to support the conductors. On the 110,000-volt tower lines the mid-span poles are 25 ft. high.

To prevent inductive and static disturbances in the telephone circuits transpositions and grounding trans-

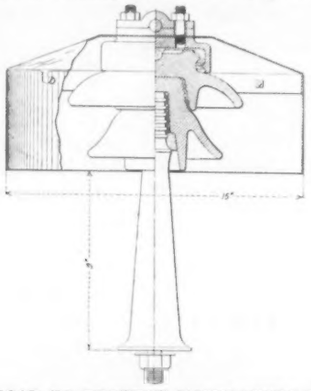


FIG. 26—HOOD TO PROTECT INSULATORS FROM DUST DEPOSIT

formers are employed. Transpositions are made at each tower support and at each mid-span pole. Telephone booths are situated about every four miles along the transmission lines. Grounding transformers are placed at all terminals and at intermediate points about 6 miles apart. The middle point of the primary winding is grounded so that static charges may escape to ground. An insulated platform is provided on which a person may stand while using the telephone.

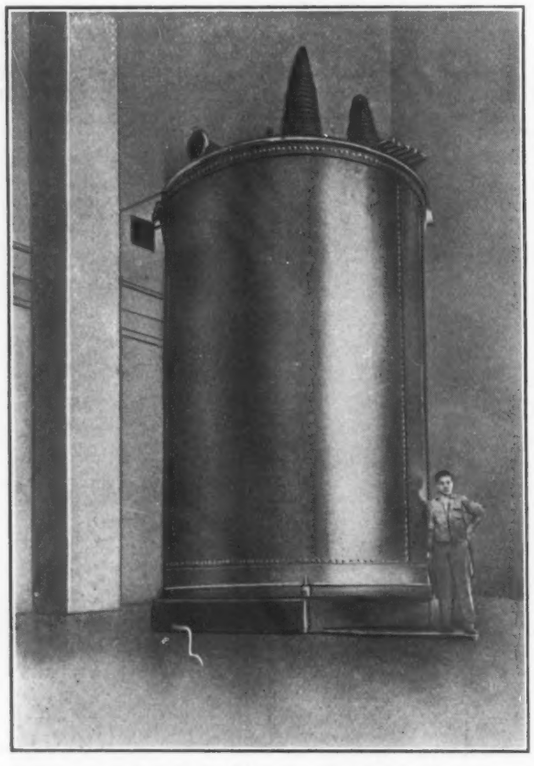


FIG. 27—110,000-VOLT TRANSFORMER

The Lehigh Navigation Electric Company's station at Hauto was designed by the firm of L. B. Stillwell, consulting engineers, New York. All generators and transformers were furnished by the General Electric Company, and the switching apparatus and lightning arresters by the Westinghouse company.

Ballast Characteristics of Boron When Used in Voltage Control

The principal commercial uses of boron are based upon its peculiar properties of high specific electric resistance and its negative temperature coefficient, as pointed out by Dr. E. Weintraub, director of the General Electric Company's research laboratory at Lynn, Mass., recently. Dr. Weintraub gave an interesting account of his researches before a meeting of the American Electrochemical Society.

The specific conductivity of boron at 0 deg. C. is about 6×10^{-5} mhos per cm cube. This high resistance is also accompanied by a large negative temperature coefficient, quite unprecedented among the elements. At ordinary room temperatures the conductivity of boron doubles for every 17 deg. C. of change. Addition of even one-tenth of 1 per cent of carbon to pure boron will increase the latter's conductivity many times. Boron containing 7 per cent to 8 per cent carbon has a conductivity comparable to that of silicon or even carbon.

If the current passing through a piece of pure boron is increased, the voltage at the terminals of the boron rises until it reaches a sharp maximum, after which with further increases of current the voltage across the terminals decreases. This property at once sug-

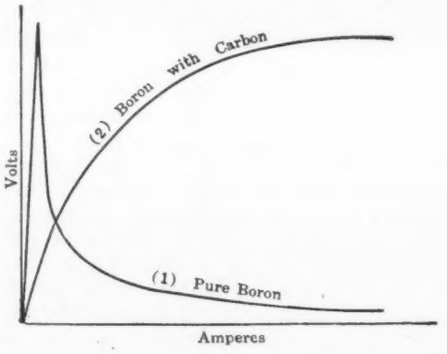


DIAGRAM SHOWING THE VOLTAGE-AMPERE CURVES OF BORON BALLAST CELLS

gests the use of boron as a cut-out, and Dr. Weintraub expressed the belief that in such cut-outs boron will find a large field of usefulness especially in connection with series lighting. Whenever the voltage rises beyond a certain value the boron cut-out, which before had a very high resistance, will break down and open a path for the current.

If a little carbon is added to the boron the nature of the volt-ampere curve changes, and by adding more and more carbon a form of the curve may be obtained which reaches a maximum and then remains practically constant, becoming parallel to the ampere axis. Such boron-carbon resistors are practically applicable for voltage regulators. The principle is that if such a boron-carbon resistor is in shunt with a conductor to be regulated, and if the current fluctuates, the boron-carbon conductor will absorb more or less current while the conductor in parallel maintains its amperes constant so that the voltage at the terminals remains constant. This property is made use of in car-lighting regulators.

Another type of boron-carbon resistors in an atmosphere of nitrogen (containing a little less carbon than the type just discussed) is employed for automobile-lighting regulators to take care of the variations of speed. These regulators are placed in the field of the generator.

Electric Cooking on the Battleship "Texas"

Coal-fired ranges superseded by ranges of the electric type on the newest United States warship—All culinary operations for nearly 1000 men carried on by electricity—Menu

THE U. S. S. *Texas*, the most recently constructed battleship of the United States Navy, which left the Brooklyn Navy Yard on May 13 bound for Vera Cruz, is the first battleship on which coal-fired ranges have been entirely replaced by the electric type. The equipment consists of ten ranges in the general-mess galley, five in the officers' galley, and two bakers' ovens.

The immense extent of the cooking operations on board this ship is only realized after considering the quantity of food prepared and the number of people served. The crew consists of 900 men and the officers number about 70. The accompanying menu is typical of the meals served to the crew. The officers' meals are a little more elaborate, but the quantity of food served is about in proportion to the numbers given. Coffee, tea, boiled meats and vegetables for the general mess are prepared in steam-jacketed caldrons and therefore do not require the operation of the electric ranges. In the officers' galley, where less food is prepared, electricity is used exclusively for cooking and even boiling.

As shown by the menu, about 6300 lb. of bread is required per week, not including that consumed in the officers' quarters. The other cooking operations, named in the order of the quantities of food prepared by that method, are frying, roasting and broiling. More than half of the food, by weight, is boiled, while that baked and roasted about equals the amount fried.

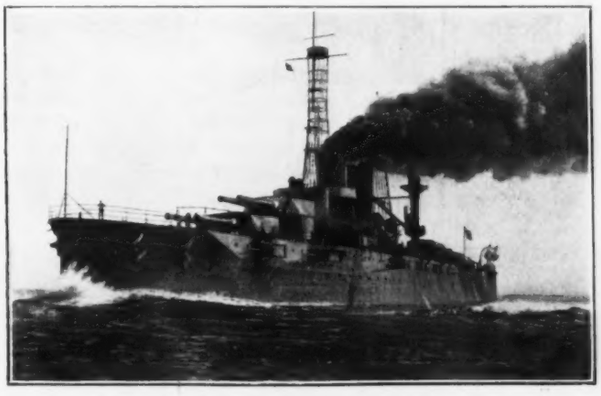


FIG. 1—U. S. S. BATTLESHIP "TEXAS"

As is customary on board a ship, the officers' and crew's galleys are separate. The former is on the main deck about midship, while the general mess galley is situated farther aft. The bakery is also separate from the galleys.

Installed in the crew's galley are ten General Electric eight-plate ranges, equipped with broilers and ovens. Each hot-plate is heated by leaf elements similar to those used in flatirons, while the broilers and ovens are equipped with the exposed-type heating element. The hot-plate units consist of ribbon resistors arranged in a wave-shape between two sheets of mica. Four of these units are clamped beneath each grid and are connected in two series groups. One set is ordinarily sufficient to maintain the proper temperature of the plate, but the second set is employed in parallel with the first for rapid cooking or for hastening the temperature rise of the plates.

The broiler and oven-heater units consist of spirally wound resistor wire which is exposed to the air and direct radiation. The broiler elements which are stretched across the top of the compartment are supported at short intervals by passing them through insu-

GENERAL MESS MENU ON U. S. S. "TEXAS" FOR WEEK ENDED APRIL 11, 1914

SUNDAY

Breakfast—Baked pork (60 lb.) and beans (66 gal.), cornbread (thirty 24-in. by 12-in. pans), and coffee (175 gal.).

Dinner—Roast pork (600 lb.), apple sauce (60 gal.), sweet potatoes (600 lb.), creamed peas (25 gal.), bread (300 lb.), oranges, and coffee (100 gal.).

Supper—Cold bologna, cold baked beans, tapioca pudding (60 gal.), bread (300 lb.), and tea (100 gal.).

MONDAY

Breakfast—Fried eggs (180 doz.), hot grits and milk (80 gal.), bread (300 lb.), and coffee (175 gal.).

Dinner—Vegetable soup (80 gal.), boiled beef (350 lb.), potatoes (450 lb.), lima beans (25 gal.), bread (300 lb.), and coffee (100 gal.)

Supper—Beef stew (140 gal.), with dumplings (30 lb.), celery, bread (300 lb.), and tea (100 gal.).

TUESDAY

Breakfast—Fried hash (600 lb.), oranges, bread (300 lb.), and coffee (175 gal.).

Dinner—Bean soup (80 gal.), ham (450 lb.), cabbage (600 lb.), potatoes (450 lb.), turnips (350 lb.), bread (300 lb.), and coffee (100 gal.).

Supper—Hamburger steak (275 lb.), fried mashed potatoes (600 lb.), bread (300 lb.), and tea (100 gal.).

WEDNESDAY

Breakfast—Baked pork (60 lb.), beans (66 gal.), catsup, hot rolls and bread (300 lb.), and coffee (175 gal.).

Dinner—Beefsteak (550 lb.) and onions (100 lb.), gravy, potatoes (200 lb.), spinach (400 lb.) and eggs (120 lb.), bread, and coffee (100 gal.).

Supper—Headcheese, cold beans, pickled beets, bread, and tea (100 gal.).

THURSDAY

Breakfast—Pork sausage (375 lb.), baked potatoes (500 lb.), bread (300 lb.), and coffee (175 gal.).

Dinner—Rice soup (80 gal.), roast beef (450 lb.), sweet potatoes (600 lb.), chocolate pudding (70 gal.), bread (300 lb.), and coffee (100 gal.).

Supper—Cold roast beef and fried potatoes (200 lb.), macaroni (100 lb.) and cheese (35 lb.), bread (300 lb.), and tea (100 gal.).

FRIDAY

Breakfast—Fried eggs (180 doz.), fried bacon (150 lb.), bread (300 lb.), and coffee (175 gal.).

Dinner—Fried fish (500 lb.), tomato sauce, mashed potatoes, mince pies (225 lb.), bread (300 lb.), and coffee (100 gal.).

Supper—Clam chowder (140 gal.), cheese, cold slaw, fruit, bread (300 lb.), and tea (100 gal.).

SATURDAY

Breakfast—Corned-beef hash (600 lb.), rolled oats (80 gal.), milk, bread, and coffee (125 gal.).

Dinner—Braised beef (450 lb.), tomato soup (80 gal.), gravy, sweet potatoes (600 lb.), kale (300 lb.), bread (300 lb.), and coffee (100 gal.).

Supper—Kidney stew (140 gal.), tinned fruit, bread (300 lb.), and tea (100 gal.).

FIG. 2—ELECTRIC RANGES IN OFFICERS' GALLEY

lated bushings set in sheet-metal barriers running crosswise of the broiling compartment. The oven units are similarly supported at both the top and bottom of their respective compartments. Extra heater elements are also installed to raise the temperature of the ovens rapidly.

Energy for cooking, as for all other electrical operations on the ship, can be supplied from either one of two generating rooms, which are situated forward and aft of the boiler room. From the main feeder circuits in each galley individual circuits are tapped off and run along the ceiling to each range.

The switches controlling the different parts of each range are placed in a compartment above the hot-plates. A main switch and fuses are installed in the middle of this panel, and on each side are five knife switches controlling the ten heater units installed in the range. The switches connected to the hot-plate and oven circuits are each equipped with an auxiliary blade which when closed allows energy to flow through the extra heater unit to produce a "high heat." The ranges in the officers' galley are of the same type, but there are only five of them.

In the bakery are two ovens each having six baking levels. The circuits are led into a compartment at one side of each oven where the control switches are installed. From these switches horizontal conducting rods lead to the heater elements at the top and bottom of each pair of baking levels. The heater elements are similar to those employed in the range ovens.

Sufficient cooking apparatus has been installed so that under ordinary conditions it is necessary to operate only four-fifths of the ovens at a time. By leaving one-fifth of the ovens idle each week it is believed that the heating units will last a longer time.

The time required to prepare each meal depends on the food to be served. The temperature of the hot-plates can be raised from normal to a working value in about twenty minutes by connecting the "high-heat" unit for five minutes at the start and using only the main element thereafter. By operating the "high-heat" units in the ovens in a similar manner the temperature can be brought up to the proper value in from twenty-five to thirty minutes. Only about six minutes is required to start the broiler.

Particular care is exercised to secure economic operation of the ranges by concentrating the cooking on a few ranges so that the inefficiency of intermittent operation is avoided. The head cook supervises the operation to see that switches are not left closed when a range is not in use.

Mr. G. L. King, first-class cook on the *Texas*, declares that he considers the electric range far superior to the coal-fired type. First of all, the use of the electric type eliminates the necessity of handling coal and ashes, consequently there is less dirt present in the room where the food is prepared. The electric range is much cooler to work around, the heat being hardly noticeable even on hot days. Furthermore, he declares it is much easier to cook with the electric equipment, as the temperature is uniform.

The ranges have been in constant use on board the *Texas* since March 12, and since that time three meals a day for a crew of 900 have been prepared without an interruption or delay. In the general-mess galley five cooks and a head cook are required each watch. In the officers' galley there are four cooks, one for each officers' mess.

Previous to the regular operation of the electric ranges some trial tests were conducted to ascertain the energy consumption in terms of the amount of food prepared, and results of value were thus obtained.

Mr. M. A. Libbey is the electrical officer stationed on the *Texas*.

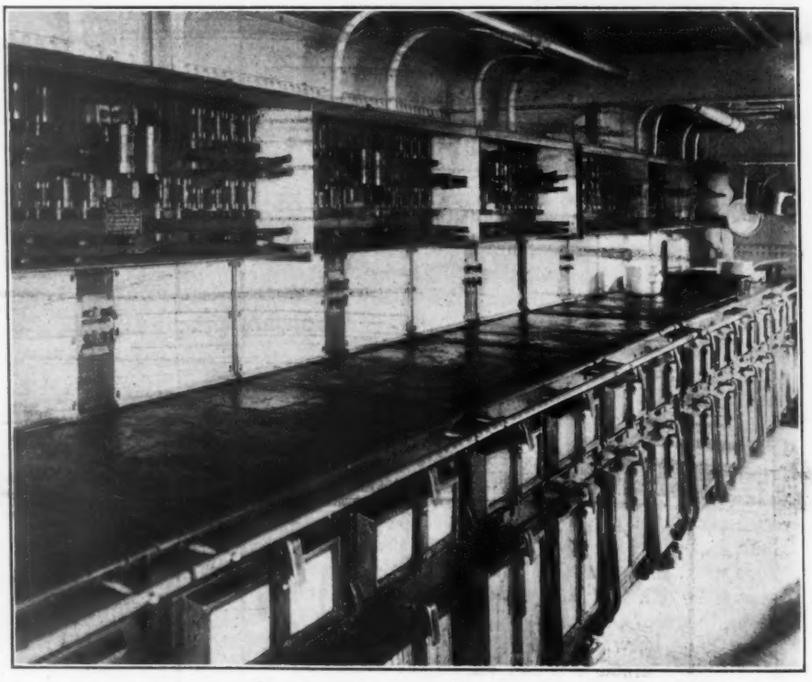


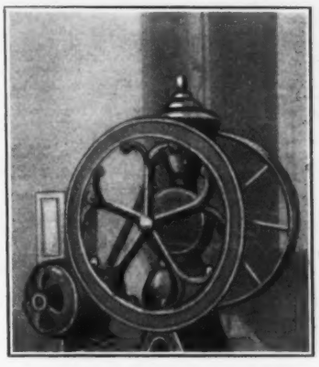
FIG. 3—HALF OF ELECTRIC RANGES IN GENERAL MESS GALLEY

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods and Current Practice Among Successful Utilities

Saving the Customer's Time

A retail grocery merchant at Mattoon, Ill., has mounted a motor-driven coffee mill in the show window at the front of his store to convince his customers that they will not be obliged to wait for a pound of coffee while a listless clerk grinds it with a hand machine

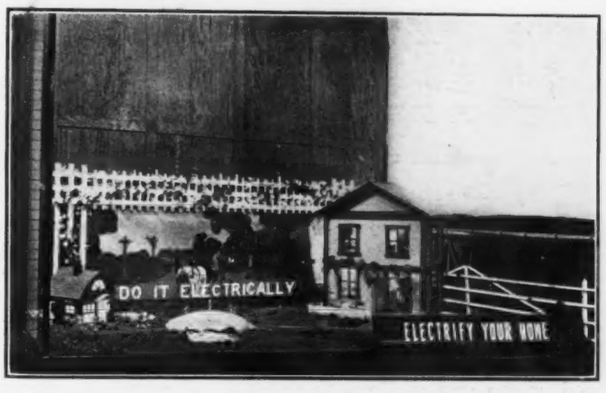


MOTOR-DRIVEN COFFEE MILL

revolving at about 3 r.p.m. The motor which is belted to the coffee mill is a 0.25-hp, 110-volt, 1350-r.p.m. direct-current machine manufactured by the Emerson Electric Company, St. Louis, Mo. When asked how much time was required to grind a pound of coffee with the electrically driven machine the dealer said he had never timed it but that it took "considerably less than a minute."

Window Display to Illustrate Electrical Comfort

During a recent house-wiring campaign in Fort Madison, Ia., the Fort Madison Electric Light Company fitted up one of its office show windows to repre-



WINDOW DISPLAY AT FORT MADISON, IA.

sent a suburban estate fully equipped with electric service. The display consisted of a miniature house and barn lighted by electricity. In the background was a sign reading "Do It Electrically," while nearer the window was another sign worded "Electrify Your Home." To appeal to the human interest of the observer and make the scene more attractive and lifelike, miniature dummy models placed around the estate were represented as engaged in some occupation commonly indulged in around the home. Sitting on the front porch of the house was a miniature representation of an elderly lady reading, while behind her peering through the window was a child seated in a high chair. Represented pictorially in the background was a stagecoach drawn up at the roadside with some new arrivals just stepping out of the vehicle. The front porch lighted by a small incandescent lamp and the interior of the house, which was made visible by the bright illumination within, gave an especially homelike appearance to the scene.

Electric Cooking in Southern Households

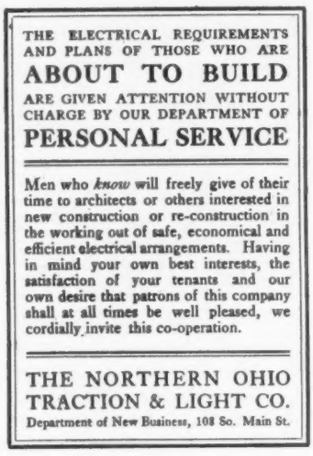
The South has in general been a difficult section in which to introduce electric cooking devices on account of the prevalence and cheapness of negro "help" and the difficulty of educating this class of servants in the economical use of electric-heating apparatus. Most of the colored cooks live at home and "go out for the day." In certain sections it is even difficult to get these independent servants to prepare any other meal than the midday "dinner," leaving to the mistress of the house the task of getting ready both breakfast and supper. The condition described has opened up a demand for electric cooking devices, and one Southern plant manager has already acquired a considerable connected cooking load in households which are servantless night and morning. A special rate of 4.5 cents net per kw-hr. is offered for this cooking business.

Teaching the Salesmen to Sell

Twelve scholarships in a Chicago school of salesmanship were recently purchased by the Columbus Railway & Light Company and offered to solicitors in its new-business department. The terms of acceptance in each case specified that the company was to bear one-half the expense, the other half being taken from the solicitor's salary in small monthly payments. Each of the twelve solicitors in the new-business department accepted the offer and these men are now holding bi-weekly meetings with the resident instructor. These sessions are held on Thursday evenings, and on the alternate weeks Mr. W. A. Wolls, sales manager, himself meets with the salesmen, helping them, through a series of talks, to understand the fundamentals in the production of electrical energy. In commenting upon the success of the school and the value of the weekly meetings Mr. Wolls says that the results obtained have made the work well worth while. To the fact that the men accepted the offer voluntarily and are themselves helping to bear the financial burden of their education is attributed no little part of the success of the plan.

A Department of Personal Service

In the electric-service division of the Northern Ohio Traction & Light Company, at Akron, Ohio, a department of "personal service," in charge of Mr. H. B. Bixler, has been instituted. As stated in the accompanying advertisement, the men of this department


THE ELECTRICAL REQUIREMENTS AND PLANS OF THOSE WHO ARE
ABOUT TO BUILD
ARE GIVEN ATTENTION WITHOUT CHARGE BY OUR DEPARTMENT OF
PERSONAL SERVICE
Men who know will freely give of their time to architects or others interested in new construction or re-construction in the working out of safe, economical and efficient electrical arrangements. Having in mind your own best interests, the satisfaction of your tenants and our own desire that patrons of this company shall at all times be well pleased, we cordially invite this co-operation.
THE NORTHERN OHIO TRACTION & LIGHT CO.
Department of New Business, 108 So. Main St.

ADVERTISEMENT DESCRIBING PERSONAL-SERVICE DEPARTMENT

freely give their time to architects or others interested in new construction or reconstruction, in order that safe, economical and efficient electrical arrangements may be worked out. By inviting the co-operation of those who are about to build, the company hopes to bring about a condition wherein its patrons will at all times be well pleased. Publicity is given to the company's offer through *The Traction Bulletin*, which is distributed on the company's cars.

The Annual Cycle of an Engineering Department

The work of the engineering department of a great electric-service organization like that of the Commonwealth Edison Company of Chicago is both interesting and important. In a recent N. E. L. A. company-section meeting Mr. Herbert A. Fife outlined in part the work of the engineering department of the Chicago company. He said that the principal work can probably be best described by following it through an annual cycle. This naturally begins with the estimate for the next year's load to determine the additional generating and converting apparatus which will be required. Then comes the preparation of the budget, which is based on the rating required in the operating system and also on other items of information received from various departments. This budget is submitted to the budget committee, which, if it approves, recommends it to the president. Upon approval of the budget by the board of directors, formal orders are sent to the firm of Sargent & Lundy for professional services in connection with plans and contracts for steam and mechanical installations, and to the architects in connection with buildings. The general plans of the year's work being based on the budget, the details are further worked out, working order requisitions are issued based on costs and contracts, and all work coordinated with that to be done under the immediate supervision of the department. Plans and instructions for the electrical equipment in generating plants and the complete equipment for converting, transforming and storage-battery substations are prepared; also for transmission and distribution lines.

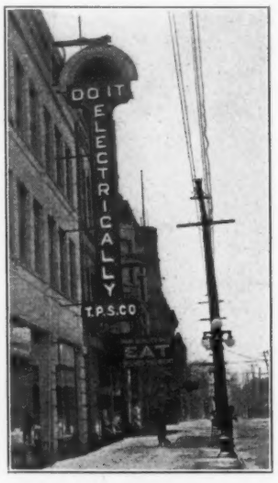
Very close co-operation is required with the architects and steam engineers, for the reason that buildings must be adapted for the proposed apparatus. Special foundations and an intricate system of ducts for cables or air, and compartments for isolation of "live" apparatus, are an essential portion of the system of the company.

Coincident with the planning of the work, the kinds of material required, quantities and specifications must be given, and as manufactories are often working at full capacity, the time element is always a very material factor in the year's work. When the construction of the building is under way the engineers on building construction must see that its completion will not delay the installation of the apparatus soon to be received, and the engineers on electrical construction must see that the construction department has the necessary plans and instructions so that all the work will go steadily on. The apparatus is put into service by deputy starting engineers of the testing, construction or street departments.

Generally this cycle is completed in October and November, and then begins anew the comparing of the actual loads with those previously estimated and the beginning of a new cycle.

A "Do It Electrically" Sign at Warren, Ohio

A sign two stories high and containing 1228 10-watt lamps has recently been erected in front of the office of the Trumbull Public Service Company at Warren, Ohio, admonishing the passing public to "Do It Electrically." The ninety-six circuits of the sign are controlled from a flasher on the roof and light successively groups of the lamps forming the border. This operation gives the effect of streams of light running toward the top, and when the last of each border group has been lighted, the fan-shaped group of lamps at the top of the sign is illuminated in three sections, respectively



ELECTRIC-SERVICE COMPANY SIGN

red, green and white. The sign was manufactured by the Kerr Sign Company, of Warren.

The building in which the company's office is situated has been called the Electric Block. On the roof is a sign 4 ft. high bearing the words "Electric Block" lighted by 375 10-watt lamps arranged in double rows along the outer edge of each letter.

Two Months of a Year's Housewiring Campaign at Louisville

Louisville, Ky., has about 40,000 dwellings, of which number 15,000 are connected to the Louisville Gas & Electric Company's lines. The remaining 25,000 are now being secured at the rate of 150 a week, of which number at least half are "old" houses. The average cost of the wiring and fixtures, complete with 40-watt lamps, has been about $36.40 per house. For the purposes of the campaign the city has been divided into five districts, each in charge of a salesman who devotes all his time to securing contracts from owners of existing or "old" houses. The present campaign was started in February, and the intention is to keep it in force a year at least. Up to April 25 the number of "old-house" contracts secured was 626.

Billboard Advertising for the Central Station

Prior to the opening of the Columbus Light & Railway Company's new co-operative store and offices on North Third Street, Columbus, Ohio, eighty-seven billboards throughout the city carried advertisements such as the one shown in the accompanying illustration.

BILLBOARD ADVERTISING IN COLUMBUS

These highly colored posters, placed among advertisements of coming races and theatrical performances, were before the public for days and created much interest and comment. The posters also served to notify the public that the company was moving its new-business department from its former office on High Street to new quarters on North Third Street.

"Ice-Making Ideal Adjunct to Small Electric Plant"

An operator who for several years has had charge of a combination ice-electric plant in a Middle West town of 4000 makes the statement: "Properly operated, the ice manufacturing business is an ideal adjunct to a small electric-light plant, for reasons which have been presented so often that it is hardly necessary to repeat them. My own advice to a small company contemplating starting in the ice business would be to get first a successful and experienced ice-plant man to go over the local conditions and prepare plans and specifications. In building a new plant as an adjunct to an existing electric plant using condensing prime movers, I would employ a motor-driven compressor and install a system to manufacture ice from raw water."

Commercial Progress at Providence, R. I., During 1913

The Narrangansett Electric Lighting Company, of Providence, R. I., operates the second largest central-station system in New England and is one of the most vigorous organizations of its kind in the country. The results of the company's development of business in 1913 are outlined below through the courtesy of Mr. E. R. Davenport, who is the sales manager of the company.

A new lighting schedule, known as the "C" rate, went into effect Oct. 8, and this is considered one of the most important forward steps of the year. The rate is for customers signing a one-year contract for a demand of 0.25 kw or over, and under it energy may be used for all purposes. For a demand of 0.25 kw to 10 kw there are both a service charge of $120 per year per kilowatt of maximum demand and an energy charge of 1 cent per kw-hr. As the demand increases the service charge decreases until, with a demand of 200 kw and over, the service charge is $24 per kw of maximum demand per year, with an energy charge of 0.8 cent per kw-hr. Lamps are not supplied or renewed free under this contract, and the rates are net. Under this new rate ninety-seven contracts were signed between Nov. 5 and Dec. 31, involving 152.6 kw of additional connected load and an estimated additional yearly income of $21,147. The estimated yearly income per kilowatt of demand is $138.58, or 6.38 cents per kw-hr.

The net gain in connections for the year was 21,476 50-watt equivalents, or 47 per cent. The company sold 102,596 tungsten and Hylo lamps, compared with 79,510 in 1912, a gain of 29 per cent. The gain in Hylo lamp sales was from 253 in 1912 to 439 in 1913, due almost entirely to the opening of the "Electric Shop" in the new Turk's Head Building, to which the company's offices were moved during the year. The company's profit on the sales of tungsten lamps in the year was $3,967. In the commercial arc-lamp field there was a decrease of 107, or 25 per cent, from the total number in use on Jan. 1, 1913.

Display Lighting

In 1913 3013 kw of new lighting business was contracted for. Among the larger installations were the Turk's Head Building, 100 kw; Kinsley Building, 34 kw; Jackson Building, 30 kw, and others. Gas-lamp replacements were of frequent occurrence, notably since the introduction of the "C" rate already mentioned. Electricity superseded gas in seventy-three installations. Sign development received a notable impetus during the year. More than twenty-four installations were made of sign lighting exceeding 100 5-watt lamps each, and the installation of outline and sign lighting on the Jackson Building called for 1960 lamps of this description.

The bill-posting concerns of the city have equipped twenty of their display boards with electric lighting, there being thirty-seven electrically illuminated boards on Dec. 31, an increase of 119 per cent over the preceding year.

During the year the company renewed 186,038 carbon and miniature lamps, a gain of 1 per cent over 1912. The success of the lamp contract basis on lamp purchases during the year has continued, there being forty-one such contracts in force. Twice during the year graphitized-filament lamps were tried out on the company's 250-volt service but were discontinued on account of unsatisfactory life. All previous troubles on 5-watt lamps used in sign work have been eliminated since the adoption of the 55-volt lamp as the standard for this service.

Industrial Motor Service

The year was one of the most successful in the history of the company's "power division," the net connections having been 2456 hp, a gain of 43 per cent over 1912. This showing is largely due to the inauguration of new rate scales in effect in Providence July 1 last.

One of these, "Rate D," has a base rate ranging from 8 cents to 2.5 cents per kw-hr., with minimum charges ranging from $1 to $5 per month, and the other, "Rate F," for customers signing an annual contract with a demand of 5 hp or over, has a monthly service charge varying from $1.50 to $1.15 per hp and an energy charge ranging from 1.5 cents per kw-hr. for motors of 5 hp to 10 hp to 0.9 cent for 75-hp or larger motors. Eighteen steam engine plants were shut down, with a total rating of 1147 hp and an individual range of 5 hp to 160 hp.

Among the new contracts secured were the Terminal Warehouse Company of Rhode Island, 200 hp; the Warren Worsted Mills, 100 hp, and the Standard Machinery Company, 300 hp. The company also secured a contract for the entire power supply of the Providence & Fall River Street Railway, amounting to 400 hp and yielding an estimated annual income of $12,000. The total sales of motors during the year were $29,308, the profit from these sales amounting to $9,475. During the year no private generating plants of any description were installed in the company's territory, which includes the greater part of eastern Rhode Island.

Electric Vehicles

Twenty-nine electric pleasure vehicles are in service in Providence, a gain of 31 per cent over 1912, and there are now eighteen electric trucks in operation. The company's income from charging has increased about 300 per cent. The electric-vehicle situation was never brighter in the city, and great care is exercised in the selection and recommendation of such equipment. In the past the idea was widely held that electric vehicles were unadapted to service in a hilly city like Providence, but this point of view has undergone a change. At the Shepard Company's department store a Detroit electric delivery wagon makes four trips and delivers an average of 300 packages daily over a route on which horses formerly used could make only three trips. Four times a day this vehicle climbs a grade of about 18 per cent maximum, and it makes a run of about 40 miles every day. The entire cost of operation is only slightly more than the former horse cost, and about 33½ per cent more work is done by the electric vehicle. The cost per ton of transporting freight to the store from the freight houses and docks is considerably less than when horses were used.

Appliance Sales

During the year the company sold 3996 electric appliances, compared with 2511 in 1912, an increase of 59 per cent. Among these were 1053 flatirons, 667 toasters, 213 portable lamps, 129 stoves, 120 percolators, 58 chafing dishes, 201 egg boilers, 58 radiators, 175 grills and 95 heating pads. On April 1 the company opened a new branch office at Arctic Center and as a result more than doubled its appliance business in the district, the sales rising from 106 to 270.

TABLE OF ESTIMATED INCOME FROM ELECTRIC APPLIANCES

Article	Watts	Yearly Income
3-lb. flatiron	330	$4.50
6 lb. flatiron	575	6.00
Small size water boiler	350	0.75
Chafing dish	450	1.00
Toaster	600	3.00
Egg boiler	450	1.00
Grill	600	1.80
Heating pad	60	1.00
Small vibrator	50	2.00
Percolator, pot style	450	3.00
Radiator	450	8.00
Electric oven	600	2.50
Foot warmer	250	1.00
Curling iron	50	1.00
Shaving mug	350	1.00
Hair drier	800	2.00
Tea-ball	450	1.00
Utility flatiron	330	8.00
Bell-ringing transformers	50	Intermittent service
10-lb. flatiron	800	12.00
Electric cooker	600	2.50
Sealing-wax melter	350	2.00
Sewing-machine motor	25	3.00
Drill, ¼-in.	300	1.00
Soldering iron	300	2.00
No. 50 range	3200	120.00
Sterilizer	500	1.00
Air heater	1500	8.00
Water heater	450	1.12

"ELECTRIC SHOP," NARRAGANSETT ELECTRIC LIGHTING COMPANY, PROVIDENCE, R. I.

The Electric Shop, illustrated in the accompanying photograph, was opened Aug. 18, and the appliance sales from that date to Dec. 31 totaled $8,345 gross, of which 29.6 per cent was profit in handling. The total connected load of these appliances was 527 kw, there being 3571 sold. Among these were 229 6-lb. flatirons, with 131.6-kw combined rating; ninety electric grills, total rating 54 kw; fifty-four radiators, 40.5 kw; 117 toasters, 70.2 kw; 2150 10-watt miniature lamps, 21.5 kw, and twenty 5-lb. flatirons, 11.5 kw. The maximum domestic rate is 10 cents per kw-hr.

Illumination and Wiring

Exterior Lighting of Salt Lake City's Electric Shop

The electrical illumination of the front of the Utah Light & Railway Company's new commercial office, 154 Main Street, Salt Lake City, has made that building at night easily the most conspicuous point along the city's principal business street. As shown in the accompanying illustration, nearly 40,000 cp in tungsten lamps is used on the front of the little building, the effectiveness of this lighting being further enhanced by the finish of glistening white tile which is employed on the building front.

The "Do It Electrically" sign measures 20 ft. by 20 ft. and contains 1200 15-watt tungsten lamps. Bordering the sign is a triple row of lamps in colors, while a motor driving a pulley is shown in operation in the middle of the display. The sidewalk sign contains 500

NEW COMMERCIAL OFFICE, UTAH LIGHT & RAILWAY COMPANY, SALT LAKE CITY

15-watt lamps with the words "The Electric Shop" interwoven with a kaleidoscope in five colors, showing ten changes. The marquise contains 325 25-watt units in frosted round bulbs. The trolley post directly in front of the building bears four 1000-cp flaming arc lamps besides the regular city street lamp.

The main street office shown is devoted entirely to the Salt Lake company's commercial business, the general offices remaining in the company's building at 133 South West Temple Street. The staff at this commercial office, headed by Mr. Bayard W. Mendenhall, commercial agent of the company, handles orders, collections, complaints and other details of customer's business. The showroom contains, for display and demonstration purposes only, a complete assortment of energy-consuming appliances.

Heterochromatic Photometry

BY M. LUCKIESH

That the results obtained by the direct-comparison and flicker photometers disagree in most cases has been well established. Under favorable conditions this disagreement is only a few per cent, but where there is a large color difference, such as obtains when red or green lights are compared with white light or with each other, the results by the two methods differ by many per cent.[1] Another well-established difference is found in the fact that in flicker photometry a reversed Purkinje effect is encountered. That is, at low illumination red light is weighted relatively more than blue light, a phenomena directly opposite to that obtaining in ordinary direct-comparison photometry. These facts are sufficient to encourage inquiry into the phenomena underlying the flicker photometer.

The flicker photometer has won many adherents owing to the ease with which lights of different color can be compared. Even inexperienced observers find little difficulty in making consistent observations. Many adherents have assumed that the flicker photometer yields true measurements of brightness in spite of the fact that no extensive comparison of the flicker and direct-comparison photometers has been made until recently. Ives[2] concludes that the flicker photometer used under certain conditions is best suited to the comparison of lights of different color, but realizes that it is inevitable that correction factors must be applied. The latter is evident from an inspection of the data obtained by eighteen observers as presented by Ives. It is found that extreme observers would measure red or blue light, for instance, againt "white" light with a difference of more than 100 per cent. Even when comparing yellow light with "white" light, the results of extreme observers differed by as much as 20 per cent. These differences, of course, emphasize the need of a standard eye. Ives further shows that the flicker method fulfils certain axioms which must be demanded of a true method of photometry, namely, brightnesses measuring equal to the same brightness measure equal to each other, and the sum of the measurements of the parts is equal to the measurement of the whole. The writer finds these two axioms practically fulfilled (at least within a few per cent) by the flicker photometer under the special conditions of the experiment; however, a method can completely satisfy these requirements and yet measure something not true brightness.

It is not the intention to discuss the relative merits of the flicker and direct-comparison photometers, but the foregoing suggests that it will be interesting to search for possible reasons for the differences in the results obtained by the two methods. The phenomenon of simultaneous contrast may be effective in comparing colored lights by the direct-comparison method, but the experiments up to the present time have been confined to the phenomena which are probably involved in flicker photometry. Where flickering lights are observed it is at once obvious that the rates of growth and decay of the color sensations are very likely to be involved. H. Morris Airey[3] has already suggested that the results obtained with a flicker photometer might be influenced by the different rates of growth of color sensations. Broca and Sulzer[4] have studied the growth of sensation with colored lights and white light. They find that in general there is an overshooting of luminous sensation before the final steady value is reached. This overshooting becomes greater as the intensity of the stimu-

[1] *Electrical World*, March 22, 1913, and April 19, 1913.
[2] *Phil. Mag.*, 1912.
[3] London *Electrician*, Aug. 20, 1909, page 758.
[4] *Comptes Rendus*, 1903, pages 944, 977, 1046.

lus is increased. The writer's experiments, which are to be described in detail in the *Physical Review*, were designed to ascertain, if possible, whether this time element in the growth of sensations is accountable for the differences in the results obtained by the two methods of photometry. In previous work two colored lights—red and blue-green, practically complementary to each

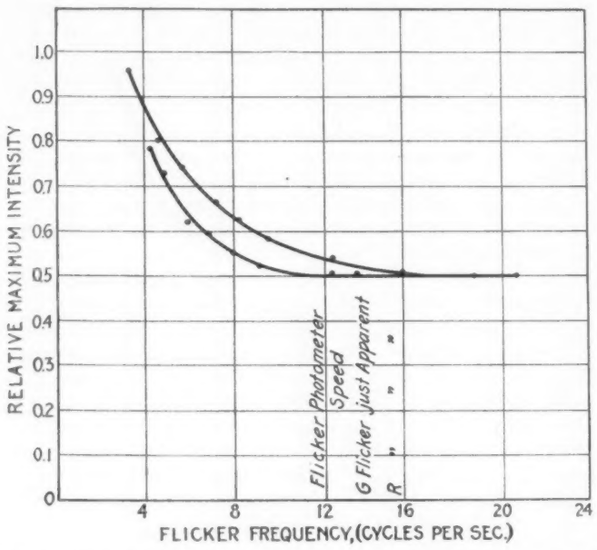


FIG. 1—COMPARISON OF INTENSITIES WITH RED AND GREEN LIGHTS

other—were selected because of certain advantages. The present work was done chiefly with these two colored lights, which were first balanced against a standard white light many times on different days, thus establishing values which were used throughout the work. When one of these lights was flickered by means of a 50 per cent sector disk and compared with a steady light of the same color, it was found possible to measure the maximum value attained throughout a wide range of flicker frequencies. At all speeds of flicker the maximum sensation of the red flickering light was considerably greater than that of the blue-green light, when these two illuminations resulted from balancing each against a standard white light by the direct-comparison method. Results obtained at an illumination of 5 meter-candles are shown in Fig. 1. The results thus obtained were in general of the same character at various illuminations and show that the maximum values of sensation at a given frequency and the critical frequencies of these two lights after being equated to a standard white light by a direct-comparison photometer are not the same. While in the flicker photometer the two lights are flickered against each other instead of being flickered against darkness, this experiment suggests a possible reason for weighting red light more than a blue-green light by the flicker method than by the direct-comparison method, a fact already established for the writer's eye. If this effect is operative in the flicker photometer, it is obvious that the red light must be diminished in intensity in order that its flicker shall just disappear at the lowest speed at which the flicker of a blue-green light disappears. At any lower frequency of flicker the red light must also be diminished in intensity in order that it may be made to appear to be agitated to just the same degree as the flickering blue-green light. When the intensities of these two colored lights were those obtained by balancing each against white by the flicker method, the curves shown in Fig. 1 appear to coincide.

Another striking experiment is found in flickering the red light upon a steady blue-green field and vice versa. The red and blue-green lights of the same intensities, as determined by balancing each against white by means of the direct-comparison method, were arranged on opposite sides of an ordinary direct-comparison photometer with identical 50 per cent sector disks intervening. On one side of the photometer field the red light could be flickered, while on the other side the blue-green light could be flickered at the same time. Another pair of lights, one red, the other blue-green, were placed one on each side of the direct-comparison photometer between the sector disks and the photometer. Each of these was of the intensity of maximum value of the first pair of lights as measured by the direct-comparison method. Thus on one side of the photometer field a red light flickered upon a steady blue-green field, while on the other side a blue-green light flickered upon a steady red field. At a high speed of the sector disks (which were identical and fastened to the same shaft) the two fields balanced accurately in brightness and color. As the speed was lowered the field upon which red light flickered upon a steady blue-green field became agitated before the other field showed any signs of flicker. In fact, the former field became violently agitated before the latter field flickered noticeably. This again points strongly to the reason for weighting the red light more than the blue-green light in the flicker method than in the direct-comparison method. Next the maximum brightness of each field was determined separately throughout a wide range of flicker frequencies by comparing with a steady white field. In this case there was only a slight color difference. The results of this experiment are shown in Fig. 2. It is seen that there is a distinct overshooting of luminous sensation in both cases, but more marked in the case of the red light flickering upon a steady blue-

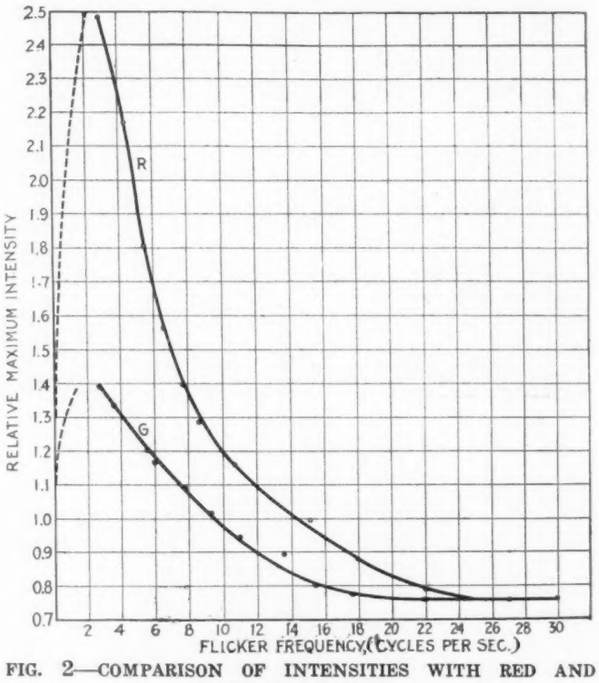


FIG. 2—COMPARISON OF INTENSITIES WITH RED AND GREEN LIGHTS

green field. The overshooting in the case of flickering the light against darkness is not so apparent.

Experiments were performed in adding these colored lights by pure superposition and by means of flickering one against the other, the flicker speed being above that at which flicker is apparent. No difference in brightness of these two fields was observed.

An interesting experiment, the results of which point with favor to the flicker photometer, is found in comparing lights of the same color but differing in spectral character. By means of dyes two yellow lights identical in color were produced. One was a pure yellow while the other was a subjective yellow composed of green and red light. These were balanced by the direct-comparison method very readily, because there was no color difference. When balanced by the flicker method it was found that the results were the same as obtained by the direct comparison balance within at least 1 per cent. The same experiment was performed with "white" lights, one being the continuous spectrum light from a tungsten lamp, the other being made by mixing red and blue-green lights. Here, again, the results were practically the same by the two methods. These experiments indicate quite strongly that the flicker photometer is not affected by the difference in the rates of growth and decay of color sensations. Of course, other combinations of colored lights to produce two lights of the same color but differing in spectral character might give different results by the two methods. If no differences are found, it might be fair to assume that the flicker photometer measures true brightness and that the differences in the results by two methods are entirely attributable to the effect of simultaneous contrast and other phenomena involved in the direct-comparison method. The latter method does not satisfy the fundamental axioms already mentioned, which is a serious cause for looking upon this method with disfavor when seeking a reliable method of photometry for the standardization laboratory. In summing up the evidence it appears that for a laboratory method the balance is in favor of the flicker photometer.

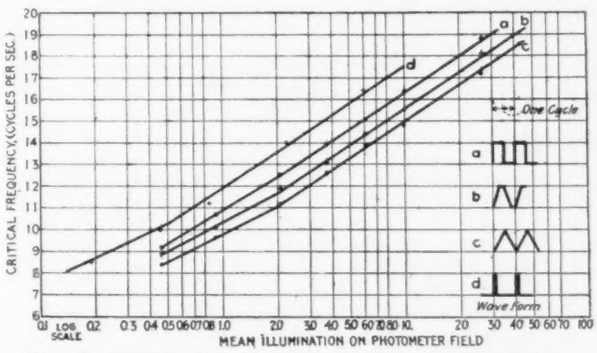


FIG. 3—EFFECT OF CONTOUR ON FLICKER FREQUENCY

The effect of the contour of flicker was also studied to ascertain the possibility of the character of the flicker in influencing results obtained by means of a flicker photometer. Four contours of flicker, as shown in Fig. 3, were studied, in each case the minimum brightness being zero and the maximum values equal. In these cases the critical or vanishing-flicker frequencies were found to be quite different throughout a wide range of illumination. The results are shown in Fig. 3, the illumination being plotted on a logarithmic scale. Porter[5] has found that for white light $f = A \log I + b$ represents the relation between critical frequency and illumination, A and b being constants. At low illuminations A has a value differing from that at high illuminations. The data show that the character of the contour of flicker is possibly of importance in flicker photometry and also serve to condemn the critical-frequency method as a means of photometry unless the character of flicker is standardized. It might be stated that the method of critical frequency has already failed as a practical method of photometry owing to its insensibility. Flicker photometers differ in principle. In some the operation is such that one stimulus ceases abruptly and is replaced by another stimulus with equal abruptness. In other photometers this change is less abrupt. In a flicker photometer devised by the writer the operation is such that the two lights are mixed together in all proportions throughout one cycle. Whether the differences in construction will cause a difference in the results obtained is unknown, yet it is quite possible.

The results shown in Figs. 1 and 2 were obtained from conditions approximately at the extremes of a cycle of operation in flicker photometry. They seem to account at least for a large part of the difference between the results obtained by the direct-comparison and flicker methods of photometry. They throw little light, however, upon the question as to which method measures true brightness. In fact, it is impossible for any method to measure true brightness in one sense, for brightnesses as the eye sees them are influenced greatly by their environment. In fact, the photometer field is always a special condition. Of course, it is highly desirable to obtain a method which is sensitive and reliable even under the special conditions. The flicker photometer is satisfactory from several standpoints, yet corrections are inevitable even with this method. For practical photometry of ordinary illuminants the use of standardized colored screens appears to be the most desirable method of avoiding color differences at the present time. This, however, involves the choice of a method of standardization. The use of colored light is becoming more extensive. The visibility or "carrying power" of signal lamps, colored lamps in signs, etc., depends directly upon the candle-power in the given direction. In prescribing colored light in illumination effects it would be desirable to know relative candle-power values. Yet without an accepted method of color photometry such data become meaningless. The writer has found it convenient to prescribe colored light in terms of watts when dealing with incandescent lamps. This method has the disadvantage of not being applicable to all illuminants and also of being dependent upon the operating efficiency of the filament. Nevertheless, the method has been found practicable for illuminating purposes. However, this is not a solution of the problem of color photometry for standardization laboratories, and it is to be hoped that some movement will be inaugurated which might result in the choice of a method to be universally adopted.

[5] *Proc. Royal Soc.*, 1902, page 313.

Recent Telephone Patent

Loud-speaking telephones should increase the volume of a transmitted message without sacrificing its clearness. To obtain satisfactory results it is therefore necessary to magnify the energy of the original sound waves by intensifying the transmitted energy or by increasing the efficiency of reproduction. A patent granted to Mr. J. J. Corner, Chicago, and assigned to the Automatic Enunciator Company describes a system using the first method. A differential transmitter is employed, consisting of one movable electrode placed midway between two stationary ones with the intervening spaces filled with granular carbon. The two stationary electrodes are connected through resistances to the energizing circuit, while the movable electrode is joined by a wire to one terminal of the loud-speaking enunciator. The other terminal of the latter is connected to the mid-point of a high resistance or capacity shunting the energizing circuit.

Letters to the Editors

Low-Priced Electric Cars

To the Editors of the Electrical World:

Sirs:—The writer has been very much interested in the discussion regarding a low-priced electric vehicle, and he agrees with both Mr. H. G. Overbeck and Mr. H. H. Skinner, whose letters appeared in your issue dated April 18, 1914. These gentlemen are from widely different territories, while the writer occupies the middle ground.

I have heard a number of users of gasoline cars say that they are ready to purchase a Ford electric car as soon as it is ready for the market, and I am satisfied that every central station and every supply house at present using a wagon or an automobile will welcome a popular-priced electric vehicle.

The fact that the cheap electric vehicle will be a source of increased revenue for the central station at just the time when needed should make every central station manager enthusiastic. The abundant supply of energy now furnished by the hydroelectric plants of the South at prices within the reach of all should make everybody connected with the electrical business in this territory particularly enthusiastic.

Frank Steffner,
President Chattanooga Armature Works.
Chattanooga, Tenn.

Discriminations in Prices

To the Editors of the Electrical World:

Sirs:—The revised Clayton bill, just reported to Congress and now slated for immediate passage by the House of Representatives, provides that any concern which shall discriminate in price between different persons or different localities in the United States (except on account of difference in grade, quality or quantity of goods sold or differences in cost of transportation) "with the purpose or intent thereby to destroy or wrongfully injure the business of a competitor" shall be liable to a fine of $5,000 and to imprisonment of one year.

The clause in quotation marks, apparently, is relied upon as limiting this prohibition of price discriminations that transgress the ethics of business competition. Two facts, however, make this view doubtful.

First—This section presumably adds something to the Sherman law; and since the Sherman law, as already interpreted in many decisions, now plainly forbids all price discriminations that injure the business of a competitor in such degree as to restrain or monopolize trade, it must be assumed that this section forbids all price discriminations that injure the business of a competitor even though they fall short of restraining trade.

Second—With "intent to injure" substituted as the standard in place of "restraint of trade" and with the inexorable presumption of law that a man always "intends" the natural and reasonable consequences of his acts, it follows that "intent to injure" must be imputed to every act by which one man obtains business in competition with another; so that price discriminations between different purchasers or different localities, adopted simply to avert business disaster, or to move unsalable goods, or to get a foothold in new territory, but which necessarily get trade away from a competitor and thus "injure" his business, may fall within the prohibition of this section.

A manufacturer or jobber having branches in widely separated parts of the country might find himself greatly overstocked at one of his branches. Overstocked with unsalable goods, his credit becomes curtailed and he must extricate himself immediately or go to the wall. The only course open to him is to sacrifice the goods accumulated at that branch for whatever they will bring. To require him to make corresponding reductions at all his other branches and to cut under prices at which all his other branches are making easy sales would immediately and needlessly hasten his ruin. To forbid him to make special price reductions at his overstocked branch would mean curtailment of his credit and no less certain ruin. Yet both of these results are compelled by the section above quoted.

Instances like this are normal occurrences in business. How frequent and pervasive are the conditions producing such instances may be realized by reflecting that seasonal changes, weather conditions and fashion effect local changes in the demand for almost every commodity that is sold. Until legislation attains the perfection of controlling the fundamental laws of nature, both animate and inanimate, it should refrain from prohibiting business men from conforming to their inevitable and unforeseen operation.

New concerns, trying to get a foothold against long-established rivals, would be even more cruelly affected. Independent tobacco manufacturers, trying for the first time to get into New York City territory, have to offer special price inducements. Following the customs of the retail tobacco trade, they offer the attraction of low "introductory prices," "free deals," "premiums," special allowances for "sampling," for window display and for advertising, and other substantial price inducements. To forbid such an independent tobacco manufacturer, struggling against odds to gain a foothold in territory already occupied by competitors, to deviate from the prices which he maintains in territory where no such conditions prevail is practically to prevent him from ever getting into competitive territory and to award a substantial monopoly to his competitors.

A flour milling concern at Oswego, N. Y.—to cite another instance—meets competition outside of Oswego throughout New York State from the Minneapolis mills. Freight rates from Minneapolis to various New York points are about the same, but freight rates from Oswego to these points differ considerably. In order to sell its flour, the Oswego concern must meet the price of its Minneapolis competitors, freight included. This it cannot do by selling to every customer at the same price, freight added. Instead, it must sell in each locality at a different price, fixing the price at such a figure that with freight added the price of flour delivered will be as low as that of its Minneapolis competitors.

To forbid the Oswego concern to fix its price in such a manner would give its Minneapolis competitors a monopoly throughout the rest of the State. The monopoly thus legalized would be as complete and oppressive as any punishable under the Sherman act. Yet if the Oswego concern endeavored to break this monopoly, to meet the prices of its Minneapolis competitors in the manner above described, it would be a crime, and its officers, directors and employees would be criminals and each subject to a fine of $5,000 and a year's imprisonment.

Differences in grade, quality and quantity of goods sold and differences in cost of transportation are allowed for in this bill. Differences in the conditions and the cost of distribution, however, which are equally real and even more important are very unjustly ignored.

New York, N. Y. Gilbert H. Montague.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Economy in Flat Arches for Fire-Box Service

As it becomes necessary to renew the arches under the boilers of the Springfield (Ill.) Light, Heat & Power Company's plant flat arches are being substituted for the sprung arches which have hitherto been erected in that station. Mr. R. E. Hagenah, superintendent and chief engineer for the company, states that a saving of approximately 62.5 per cent is effected by this change in design, as the flat arches can be constructed for three-fourths the cost of sprung arches and the life of the former has proved to be fully twice as long as the latter. The boilers in the station are all of the water-tube type and fuel is fed to the grates by means of chain-grate stokers. The boilers are of three makes, namely, Stirling, Babcock & Wilcox, and Springfield.

Fuel Losses Due to Excessive Draft

The penalty of operating boilers under too great draft was well exemplified in an instance cited by Mr. Charles M. Rogers, efficiency engineer for the Meridian (Miss.) Light & Railway Company, before the recent Mississippi Electric Association convention.

The plant mentioned by Mr. Rogers was situated in an important bituminous coal field where the best grade of fuel was obtainable without freight charges. Its furnaces were arranged for burning about 7 lb. of coal per sq. ft. of grate area, but owing to careless fire-room regulations a draft of 0.55 in. to 0.60 in. of water column was maintained on these boilers, or sufficient to burn 50 lb. to 60 lb. of fuel per sq. ft. of area. The result was that an excess quantity of air was passed through the fire, cooling it and diluting the CO_2 content to about 2.3 per cent. Under these conditions the fuel bill was about $1,000 a month.

Later the draft was reduced to 0.08 in., improving the efficiency and output of the boilers to such an extent that it was possible to cut one unit out of service altogether. Meanwhile the fuel consumption fell to $650 a month, showing a saving of about one-third of the former bill under conditions of poor draft regulation.

Open-Circuited Rotor Connection

Ordinarily on a three-phase slip-ring induction-motor rotor each of the three ends of the rotor winding is connected to one of the slip-rings. To this end there pass through the collector three studs, each being connected to one of the slip-rings and insulated from the other two rings. Where clear wires are run from each rotor lead to its ring, all of the studs are used. On some rotors, however, one rotor lead is connected to the spider and the corresponding slip-ring (the middle one) is grounded to the shaft, which thereby takes the place of a connecting wire. In such cases only two of the collector-ring studs are used, the third one being insulated from all rings. A machinery company sent such a rotor out to be repaired, and after it had been reinstalled it failed to start loads that it formerly had started promptly. An ammeter cut into the rotor circuits one at a time showed that only two legs of the rotor were active. Further test with the magneto showed that one of the collector rings was not connected to anything. Disassembly and inspection showed that the repairman in reconnecting the leads of the rotor had connected one of them to the dead stud, with the result that the rotor was operating with only two of its coils active on all notches of the controller. The effect was a decrease of probably 40 per cent in the motor's torque. This device is often purposely used as a means of decreasing a motor's starting torque on the first controller notch, but in such a case the open-circuiting is done by a special arrangement of the contacts on the controller cylinder.

Device to Minimize Wear of Machine Tools

The cutting tools employed on large machine-shop planers are generally so heavy that their cutting edge is rapidly dulled by dragging on the work during the return stroke of the planer bed. To eliminate this unnecessary wear, the scheme illustrated herewith can be employed. Attached to the cutting head of the planing machine is a solenoid, the plunger of which is connected to the cutting tool in such a manner that it is raised from the work during the return stroke and dropped to its normal position again at the beginning of the cutting stroke. The switch completing the circuit through the solenoid is of the sliding-contact type and may be operated by the dogs which reverse the motion of the planer bed. By using this device much time lost in replacing dulled tools is eliminated.

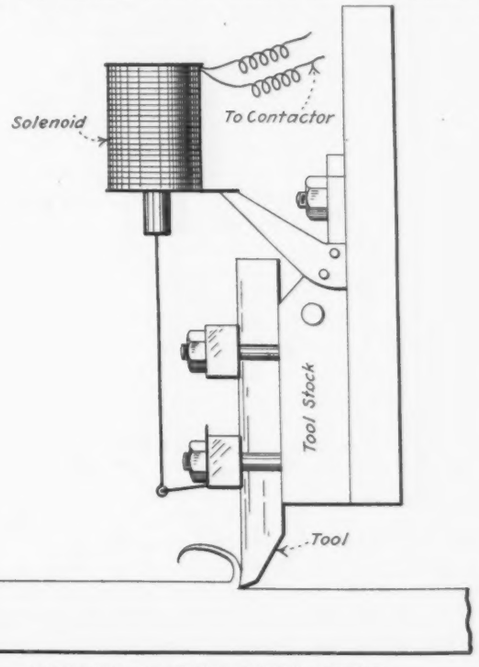


DIAGRAM OF TOOL-SAVING DEVICE

Grease in Condensers

BY R. T. STROHM

The usual form of surface condenser consists of a cylindrical shell with hollow heads, between which are inserted a large number of small tubes. Water is circulated through the tubes, and the steam to be condensed is led into the shell so that it surrounds the

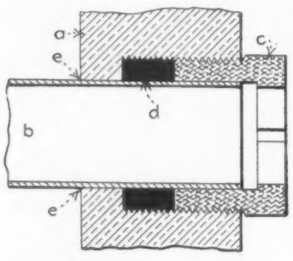


FIG. 1—DETAIL OF CONDENSER-TUBE PLATE

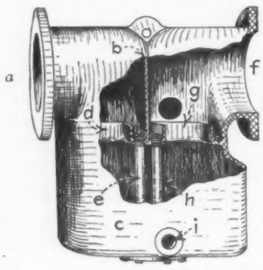


FIG. 2—GREASE EXTRACTOR

tubes. The heat of the steam passes through the tubes into the cool circulating water inside and is carried away by the water, and the steam is thus condensed.

The steam that comes over from the engine or engines brings oil with it. This oil is entrained with the steam current and exists as finely divided particles that are easily picked up and carried along. The steam in passing into and out of the cylinder travels at a high velocity, and the heat and the cutting or scouring action due to its rapid flow cause it to sweep the particles of cylinder oil from the walls of the cylinder and carry them out at the exhaust. Thus every time that the exhaust valve opens a part of the lubricant is lost in the outrush of steam. It is this continual escape of oil that necessitates the regular supply of lubricant by some form of automatic feeder attached to the steam pipe above the throttle valve.

The fact that oil is lost beyond recovery is of sufficient moment, but there is a still more important matter to be considered in this connection. The steam comes in contact with the inner surface of the condenser shell and the outer surfaces of the tubes, and as it condenses against these cooler metal surfaces, the particles of oil that have been held in suspension in it are deposited on these surfaces, where they stick. Eventually they collect in such a quantity that the tubes are thickly covered with a layer of sticky, gummy stuff having the consistency of tar.

Now, the purpose of the condenser is to remove the heat from the exhaust steam, so that the resulting decrease of volume shall create a partial vacuum. Anything that interferes with the transfer of heat from the steam to the circulating water reduces the efficiency of the condenser. The deposit of oil on the tubes serves to retard the passage of heat from the steam to the water, because it is a non-conductor of heat. The result is that the heat transfer is rendered less rapid and the vacuum is impaired, or a much greater quantity of water must be circulated through the tubes in order to maintain the desired pressure inside the condenser.

When this state of affairs is reached the condenser must be cleaned. The cleaning is a most unpleasant task, for the reason that the grease adhering to the tubes is very hard to remove from them; also, it is equally hard to remove from the hands and clothes of the workmen.

The method of cleaning a surface condenser is to remove the tubes, which is done by loosening the fastenings of the tubes and drawing the tubes out of the tube plates. A common method of connecting tubes and tube plates is shown in Fig. 1. The holes drilled in the tube plate *a* are made very slightly larger than the tubes, one of which is shown at *b*. On the water side the hole is counterbored and tapped to receive a gland *c*. Packing, *d*, is inserted at the bottom of the counterbored hole and the gland is screwed in tightly, compressing the packing and preventing leakage around the tube, yet allowing the latter to slide endwise in order to compensate for expansion and contraction.

To clean the tubes, the glands are unscrewed and the packing is taken out. Then the tubes are pulled out through the tube plate. As the hole in the plate is only slightly larger than the tube, the grease that adheres to the tube will be scraped off by the plate and will collect at *e* or fall to the bottom of the shell. After the tubes have been drawn, the workman must enter the shell and remove the grease from the tube plate and the shell.

The grease is tenacious and adheres closely to the metal surfaces, but it may be softened by the use of kerosene or gasoline, either of which will cut it. If either of these oils is used to facilitate the cleaning, care must be taken not to bring a naked flame into or near the shell, as the inflammable gases rising from the oil may ignite and cause an explosion.

In view of the loss of efficiency caused by grease in a condenser and the time and labor required to clean it out, some method should be used whereby the exhaust steam may be freed of the entrained oil before it is permitted to enter the condenser. This end may be accomplished by putting a grease extractor in the exhaust pipe between the engines and the condenser.

One form of grease extractor designed to be placed in a horizontal pipe line is illustrated in Fig. 2, one side being broken away to show the construction. The exhaust steam enters at *a* and, meeting the partition *b*, is deflected downward into the body *c* of the extractor. The abrupt change of direction causes the oil to be thrown against the partition; also, the lip *d* around the inlet serves to catch and retain the oil particles. The

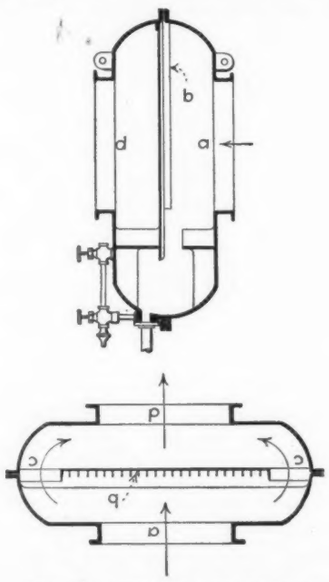


FIG. 3—GREASE SEPARATOR

grease thus collected is led into the bottom of the extractor by the pipe *e*.

The outlet side is of the same form. The whirling motion of the steam downward beneath the lower end of the partition throws the oil down into the bottom of the extractor, where it strikes the surface of the collected oil and grease and is retained, while the steam

passes up and out at *f*. Any oil that is carried up with the steam is caught by the lip *g* and carried off by the pipe *h*. The water and oil separated from the steam are led away through the opening *i* to a receiver or trap.

Another form of extractor or separator is shown in Fig. 3, in which the upper view is a vertical section and the lower view a horizontal section. The exhaust steam enters at *a* and strikes a ribbed baffle plate *b* that is set squarely across the middle of the separator. There are at the sides of the baffle plate passages *c*, through which the steam may pass to the opposite side, and there is a similar passage at the lower edge of the baffle plate. But the steam is compelled to change its direction of flow sharply in order to get past the baffle plate, and, as the oil is a great deal denser than the steam, it cannot change its direction of motion so easily. So it strikes against the baffle plate and drains to the bottom of the separator, while the steam passes through and escapes at *d*.

Starting-Box Troubles

A starting box for a direct-current motor is a simple device in itself and, with ordinary care, is not liable to many defects excepting those incident to abuse or to misapplication. The most common abuses are using the box to start a motor that is too large for it or using a box as a speed regulator; the most common misapplication is due to carelessly changing boxes from one motor to another, regardless of rated voltage or current-carrying capacity. The more common starting-box troubles are as follows: If a motor fails to start until the starting-box handle is pushed away around, it may mean that the motor is too large, or that it is overloaded, or that the service voltage is too low, or that the starting-box main resistance *R* is too high, or that it is open-circuited so that armature *a* cannot get any current until the handle has passed the open circuit. Where the brushes spit and a bad flash is drawn when the handle is thrown to the "off" position, but the motor shows no tendency to start, it generally means

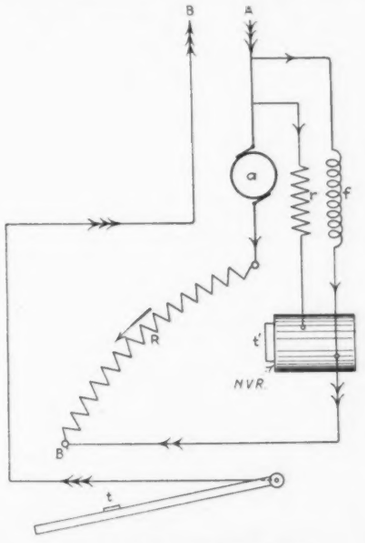


DIAGRAM OF CONNECTIONS

that the motor field circuit is open, so that the motor has no torque; but it may be due to wrong connection of the motor field coils or to two grounds that cut out a part or all of the field coils. On a ground-return circuit only one machine ground fault is needed to produce a short-circuit. If the motor starts and runs all right, but the starting-box handle fails to remain over in the operating position, it is generally due to an open circuit in the no-voltage-release coil or in the resistance that is connected in series with it, but may be due to a roasted or metallicly short-circuited no-voltage-release coil. If a starting box is used on voltage that is too high for the normal rating, the no-voltage-release coil will indicate that fact by excessive heating; if unnoticed, the coil will eventually burn out. The accompanying figure indicates diagrammatically the three circuits through a no-voltage-release starting box intended for a shunt-wound motor. The current entering at *A* divides among three paths as soon as the starting-box handle touches *B'*. In the diagram each current is indicated by one arrow head, so that the number of arrow heads indicates in each case the number of currents in any given conductor. An open-circuit in any of the three paths will cause symptoms that will suggest the location of the fault. It should be noted that when the handle bar is in the "off" position, the field, the starting resistance *R* and the armature *a* form a local closed circuit through which the field discharges when the handle bar is for any reason returned to the "off" position while the motor is operating. This device minimizes the chances of insulation being punctured by the high voltage induced when a field circuit is suddenly interrupted.

Constant-Current Transformers on Three-Phase Circuits

The writer would like your opinion on the matter of two oil-cooled, constant-current transformers of somewhat obsolete type that are constructed with four coils per transformer—two primary and two secondary, the primaries being arranged for 1100-volt and 2200-volt connections. These transformers are working at approximately three-quarters load upon two phases of a three-phase, 2300-volt system. This plan gives such a low power-factor and such badly unbalanced phase conditions that it much overloads our generators and results in considerable heating. In looking over the situation to see if there were not some way of balancing the load and improving the power-factor, the idea has been advanced that inasmuch as these transformers are working at only three-quarters load, it might be possible to use all the coils in one transformer and one-half the coils in the other—that is, one primary and one secondary—thereby improving the power-factor and possibly balancing the load. Two methods of doing this have occurred to the writer. One is the construction of a three-phase, two-to-one auto transformer and connecting one 1100-volt primary coil across each phase of this transformer, thereby working three sets of coils, two in one transformer and one in the other, to their full load and leaving one set without load. This seems to be perfectly practicable, but another suggested method that might be better is to connect these three primary coils in star, the secondary also being star-connected. Inasmuch, however, as the impressed voltage from any line to the neutral of a star connection is equivalent to 58 per cent of the primary voltage, it is quite evident that more than 1100 volts would be impressed upon these 1100-volt coils, and that a three-phase auto-transformer would have to be constructed to reduce the line voltage to the proper amount so as not to impress over 1100 volts upon these coils. There also seems to be some question as to whether the constant-current secondary would regulate satisfactorily if connected in star, assuming that there might be slight variation of load upon these. Which method is the preferable one? R. C.

Satisfactory results can be obtained by using two transformers or auto-transformers in "T-connection." With a 2300-volt, three-phase system one of these transformers would be subjected to a primary emf of 2300 volts. One terminal of the second transformer would be connected to the center tap of the first-mentioned transformer and would be subjected to an emf of approximately 2000 volts. The secondary voltages of these transformers or auto-transformers could be adjusted separately to such values as would be needed to supply energy to the constant-current transformers. With these voltages properly adjusted for the constant-current transformer circuits no trouble whatsoever should be experienced in the operation of this apparatus.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

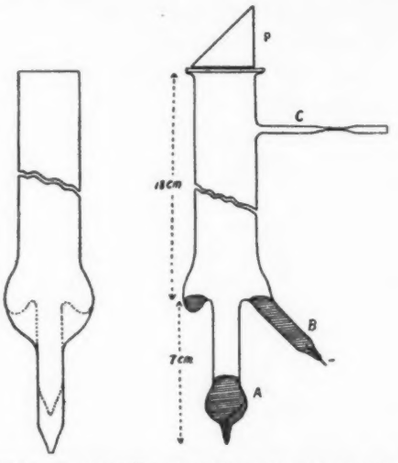
Generators, Motors and Transformers

Voltage Regulation of Alternators.—A. E. CLAYTON.—An article illustrated by diagrams on a method for determining the total equivalent reactance of an alternator winding and the calculation of the voltage regulation. The author deals with a method for estimating the equivalent coefficient of self-induction of an alternator and shows how the effect of armature reaction depends upon the saturation constant (that is, the ratio of the slope of the characteristic to the initial slope of the same) at the working point. For the total equivalent reactance the author obtains the value $\omega(L_k + SL_a)$, where ωL_k is the total equivalent reactance with no saturation, $\omega L'_a$ the equivalent reactance with no saturation corresponding to armature reaction, and S the saturation constant.—London *Electrician*, April 24, 1914.

Aluminum Rectifier.—CLARENCE W. GREENE.—An illustrated account of an investigation of the potential differences between the electrodes of the aluminum rectifier at extremely short intervals after breaking the charging circuit. After checking some of the results obtained by former investigators by the ballistic galvanometer-condenser method, a potentiometer method for measuring the counter emf was devised and the results thereby obtained were compared with those obtained by the former method. The potentiometer method invariably gave larger values for the counter emf of the rectifier than did the condenser method, the differences being far beyond the range of experimental error. The condenser method of measuring the counter emf introduces an error due to the taking of a charge from the rectifier. The rectifier does not behave as an ordinary condenser. When aluminum is used as the anode, the counter emf alone accounts for the reduction of the current to its exceedingly small value. The results obtained in this investigation are apparently in accord with the gas-film theory and the theory of ionic diffusion.—*Phys. Review*, April, 1914.

Lamps and Lighting

Laboratory Mercury Vapor Lamp.—A. H. PFUND.—An abstract of an American Physical Society paper in which the author describes a re-design of his mercury-vapor lamp for experimental work in the laboratory. He makes the lamp as follows: A glass tube 2.5 cm in diameter is drawn down at one end to a diameter of 1 cm and is closed; a bulb is then blown, and while the glass is still soft the lower end of the tube is pushed up, thus creating the annular trough shown in the dotted lines of Fig. 1. Next a side tube *B* (Fig. 2) is attached, a small bulb is blown in the tube *A*, and the platinum electrodes are sealed in. The inner end of the wire in *A* is preferably bent as indicated to avoid any possible arcing between this wire and the mercury when the lamp is started subsequently by tilting. The lamp as such is finished after the side tube *C* has been introduced and a lip (ground flat with carborundum powder) has been turned on the upper end of the tube. After the lamp has been cleaned and dried thoroughly, distilled mercury is introduced to the indicated amount and a quartz plate is attached to the open end of the tube by means of sealing-wax. After having drawn down the tube *C*, the lamp is attached to a mercury pump and the usual process of exhaustion and boiling of mercury is carried out. The lamp is then connected to a source of direct current (110 volts) through an auxiliary resistance of five or six incandescent lamps in parallel, thus reducing the current to about 2 amp.



FIGS. 1 AND 2—MERCURY-VAPOR LAMP

The discharge is started either by a high-potential discharge or by boiling the mercury in tube *A* so violently that it rushes up to short-circuit the lamp for an instant. While the lamp is still on the pump, the discharge is continued for an hour or more to drive off gases and vapors. After sealing off from the pump the lamp is ready for use. Whenever it is desired to start the lamp subsequently the tubes *A* and *B* are heated cautiously by means of a Bunsen burner and the lamp is tilted so that the mercury from *A* flows directly into the top of the tube *B*. Upon returning the lamp to its vertical position a brilliant discharge sets in. By connecting the lower electrode *A* to the positive end of the source of current, the discharge in the tube *A* becomes very steady, while a brilliant spot dances about on the surface of the mercury in the annular trough. This annoying feature is eliminated by covering the outside of the trough with black paint. The mercury which condenses in the upper part of the lamp gradually runs down into the trough, which overflows periodically into the tube *A*. By constricting suitably the larger tube above the trough it is possible to cause a portion of the falling mercury droplets to reach *A* directly—thus eliminating the sudden overflow previously mentioned. In order to avoid the condensation of mercury on the quartz window the lamp is sealed off from the pump at a pressure of about 1 mm—thus avoiding the luminous flame which shoots up the tube at high vacuums. If in spite of these precautions drops persist in forming on the window, this difficulty is overcome by wrapping strips of wet cloth about the upper part of the lamp. If it be desired to utilize the ultra-violet radiations, a totally reflecting quartz prism is introduced at *P*.—*Phys. Review*, April, 1914.

Generation, Transmission and Distribution

Winding Machines.—W. PHILLIPPI.—The first part of an illustrated article on the present status of electric winding machines in Europe, with special reference to the Ward Leonard system. A new safety device of the Siemens-Schuckert company for use in connection with this system is described, as is also a water resistance with motor relay. The paper is to be concluded.—*Elek. Zeit.*, April 23, 1914.

Traction

Swedish State Railway.—F. ZOLLAND.—A long and profusely illustrated description of the electrification of the Swedish State Railway from Kiruna to Riksgränsen, which has a length of 130 km (78 miles) and is part of the most northern railroad in the world. It is largely used for transportation of ore. Single-phase current is used, the transmission emf being 80,000 volts and the emf on the trolley wire 15,000 volts. The frequency is fifteen cycles. The power plant has been erected at the Porgus Falls in Stora Lule Älf, where when fully developed 250,000 kw will be available. The present plant contains three single-phase, 10,000-kva generators supplying energy for the railway and the 11,000-kva three-phase generator supplying energy for the mines.—*Elek. Kraft. u. Bahnen,* March 24 and April 4, 1914.

Electric Traction in Italy.—G. HULDSCHINER.—An article on the development of electric traction in Italy in 1913. The Italian trunk railways, which are mainly owned and run by the State, are operated by three-phase currents as far as they have been electrified. The long and heavy grades, the very heavy freight traffic, the relatively low maximum speeds, etc., represent conditions so advantageous to this system that the results obtained on the three-phase lines so far in existence have been very satisfactory and the government will adhere to this system. A review is given of several new three-phase lines. The conditions are different for those roads which are in the hands of private companies, and in this case either single-phase current or high-tension direct-current has been used. Notes are given on three new single-phase lines, and it is pointed out that the chief obstacle to a more extended use of single-phase system is the very strict regulations as to the prevention of induction troubles on the telephone and telegraph lines. For this reason the high-tension direct-current system has found quite extended use, probably more than anywhere else in Europe. Eight new lines of this kind are mentioned, using an emf of 1000, 1200, 1350 and in one case 1650 volts. The latter voltage is used on the line from Rome to Frosinone, which has a length of 135 km (81 miles). Originally a system using single-phase current at 11,000 volts and twenty-five cycles had been projected. But the protection of more than 100 telegraph and telephone lines in the neighborhood would have been so expensive that it was decided to adopt the direct-current system. The voltage is 1650 at no load, and with 10 per cent drop in the line an average of 1500 volts on the trolley wire is obtained. The numerous new direct-current roads with emfs below 1000 volts are chiefly trolley lines in cities. In Naples a subway is in course of erection and subways are also planned for Genoa and Milan.—*Elek. Kraft. u. Bahnen,* April 4, 1914.

High-Tension Direct-Current Line in Italy.—An illustrated article on the suburban line from Verona to San Bonifacio, on which the direct-current system at 1350 volts is employed. The motors are wound for 675 volts and are arranged in groups of two in series.—*Elek. Kraft. u. Bahnen,* March 24, 1914.

Direct-Current Traction.—M. LEGOUEZ.—An illustrated description of a new system of direct-current traction with automatic starting and recuperation of energy. This system was worked out by Ward Leonard and has been successfully used on the trial trains of the Paris subway. The characteristic feature is the omission of the starting resistors. In their stead there is a converter in three parts consisting of a regulating machine, a driving machine and an additional machine which is set in operation only when energy is recuperated. All three machines have a common axle.—*Bulletin Soc. Intern. des Electriciens,* Vol. 3, 1913, page 979; *La Génie Civil,* Vol. 64, 1914, page 275; *Elek. Zeit.*, April 16, 1914.

Electric Railways.—H. W. FIRTH.—The first part of a paper read before the (British) Institution of Electrical Engineers on the electrification of railways as affected by traffic considerations.—London *Electrician,* April 24, 1914.

Storage Battery Locomotive.—H. SCHMEUSSER.—An illustrated description of a three-axle storage-battery locomotive with three motors for switching purposes.—*Elek. Zeit.*, April 23, 1914.

Installations, Systems and Appliances

Electric Driving of Capstans.—AUG. RASMUSSEN.—The author describes a new system of electric driving of capstans in which series motors for constant current and variable voltage are employed. These are arranged in groups of two in series, with two generators designed for constant current like that by Rosenberg (Fig. 6). The control of the drive is made by one of the following three methods: In Fig. 3 different

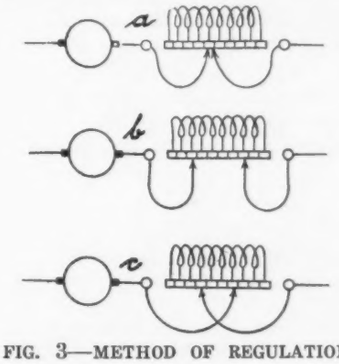
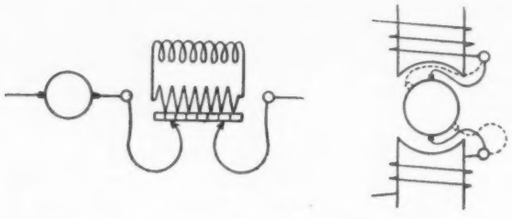


FIG. 3—METHOD OF REGULATION

points of the magnet winding are connected to the segments of a sliding contact bar along which two contacts move in opposite directions so that by a simple motion of the lever the motor may be adjusted to zero position (position *a*), or for winding up (position *b*), or for letting loose (position *c*). Since the current passing through the motor is approximately constant and independent of the load, the motor has a constant torque for a given position of the regulating device. If the motor should be overloaded, it simply stops and starts again automatically when the obstacle has been removed without a fuse burning out or something of the kind. The motor is started by removing the contacts from each other so far that a sufficient torque is obtained (diagram *b*). Thereupon the contacts are brought nearer together again so as to get the desired speed. If the motor has to be started for lowering the load (diagram *c*) the contacts are moved past each other a little so that a torque in opposite direction is produced which overcomes the friction. If the load is heavy enough to drive the capstan itself, the contacts will come back to the position *b* and the motor will operate as a generator and return energy into the network. The regulation requires only a single motion of a lever and is otherwise automatic. The second method of regulation is shown in Fig. 4. It is in principle

the same as the former one, but a resistor is provided in parallel with the magnet winding and this resistor is connected to the contact segments. The third method of regulation is shown in Fig. 5. This is the simplest method of regulation and can be used if it is not too difficult to design a direct-current motor which fulfils the requirements as to commutation. The regulation



FIGS. 4 AND 5—METHODS OF REGULATION

is carried out here simply by displacement of the brushes. The zero position is shown in the illustration in drawn-out lines, while the position for winding the load up is shown in dotted lines. The whole arrangement of the capstans and the generators is shown in Fig. 6. There are two generators of 100 kw and 225 amp constant current. Each of the two constant-cur-

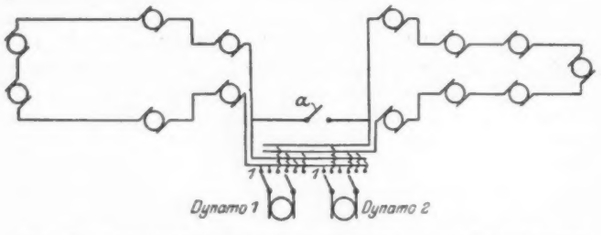


FIG. 6—ARRANGEMENT OF CAPSTANS AND GENERATORS

rent generators can be switched to one of the following three positions: (1) for all capstans in series, (2) for groups of capstans on the front half of the deck, (3) for groups of capstans on the back half of the deck. The emf of each 100-kw, 225-amp generator varies between zero and 440 volts. The latter might seem a high voltage on shipboard, but it must be taken into consideration that this is not the voltage of each motor but the sum of the voltages of all motors, and it is thought that the system is free from danger. The motors are to be designed for 225 amp and an emf of from 100 volts to 150 volts.—*Elek. Zeit.*, April 23, 1914.

Wires, Wiring and Conduits

Protective Resistors for High-Tension Oil Switches.—BRUNO BAUER.—An article illustrated by diagrams on the use of protective resistors in connection with high-tension oil switches. Their use is based on the consideration that the transient phenomena connected with any switching operation can be rendered free from danger by inserting a damping resistor. The author discusses in detail the following three cases: First, the dangerous rises of voltage and current when a switch is closed or opened on an overhead line or cable with very high tension; second, the current rush which is produced when unloaded large transformers or induction motors of modern design are switched to the line; third, the stresses produced in the switches themselves when large inductive loads or capacity loads are disconnected. The author sums up the literature which exists concerning the first two problems and gives the theory which permits a qualitative calculation of the third problem.—*Elek. Kraft. u. Bahnen*, March 14, 1914.

Electrophysics and Magnetism

High-Frequency Spectra of the Elements.—H. G. J. MOSELEY.—A second paper on the subject. The author reaches the following conclusions: Every element from aluminum to gold is characterized by an integer N which determines its X-ray spectrum. Every detail in the spectrum of an element can, therefore, be predicted from the spectra of its neighbors. This integer N, the atomic number of the elements, is identified with the number of positive units of electricity contained in the atomic nucleus. The atomic numbers for all elements from Al to Au are tabulated on the assumption that N for Al is 13. The order of the atomic numbers is the same as that of the atomic weights, except where the latter disagrees with the order of the chemical properties. Known elements correspond with all the numbers between 13 and 79 except three. There are thus three possible elements still undiscovered. The frequency of any line in the X-ray spectrum is approximately proportional to $A(N - b)^2$, where A and b are constants.—*Philos. Mag.*, April, 1914.

Radium Emanation.—HORACE H. POOLE.—A brief note on the activity of freshly formed radium emanation. The general result obtained is that the activity of radium emanation is the same within a few seconds of its formation as some minutes later.—*Philos. Mag.*, April, 1914.

Transformation of Emanations.—P. B. PERKINS.—An account of an experimental determination of the periods of transformation of thorium and actinium emanation. By successively inserting suitable capacities in parallel with the leaf of a Wilson-Kaye electroscope as decay progressed, the half-value periods of thorium and actinium emanation were found to be 54.53 + 0.041 and 3.92 + 0.004 seconds respectively.—*Philos. Mag.*, April, 1914.

Effect of Magnetic Field on the Resistance of Metallic Resistors.—WALTER A. JENKINS.—An account of an experimental investigation on the effect of a magnetic field on the resistance of nickel. Both longitudinal and transverse effects were studied. The conclusions of the author are as follows: Hysteresis curves for both longitudinal and transverse fields at different temperatures have been obtained. The effect in a transverse field is shown to consist of two parts, one which gives an increase and reaches a maximum and a second which gives a decrease and does not reach a maximum. The longitudinal effect and the first part of the transverse effect possess similar characteristics. There is some relation between the dimensional change in a magnetic field and the resistance effect, but one is not the cause of the other. Both are probably resultant from structural alteration. The ordinary theory for the effect in a transverse field does not explain the results obtained. The effect is possibly due to further structural change.—*Philos. Mag.*, April, 1914.

Magnetic Susceptibility of Water.—H. C. HAYES.—An account of an experimental investigation in which the value of the magnetic susceptibility of water at a temperature of 24 deg. Fahr. was determined by Faraday's method, the difficulties of the method having been sufficiently overcome to make it capable of giving accurate absolute results. The value of the specific susceptibility as found by this method is in excellent agreement with the results recently obtained by Quincke's method and seems to prove that this value is now known to within 1 per cent. The value is -7.26×10^{-7}. Moreover, this value is shown to be independent of the field, for the strength of the field used in this work was only 1180 gausses, while Sève, de Haas and Draper, and Weiss and Picard used fields varying from 15,700 gausses to over 21,500 gausses.—*Phys. Review*, April, 1914.

Units, Measurements and Instruments

Measuring Transformers.—H. GEWECKE.—A long article illustrated by numerous diagrams dealing with the principle of operation of measuring transformers with special reference to the variation of the transformation ratio and the phase angle between the primary and the secondary emfs or currents. The discussion is based on the use of the general transformer diagram and vector diagrams derived from it. Various zero methods are discussed which permit a very exact test of the transformer.—*Elek. Kraft. u. Bahnen,* March 14, 1914.

Telegraphy, Telephony and Signals

Wireless Telegraphy.—CHARLES A. CULVER.—The second paper on his experimental researches on the propagation and interception of energy in wireless telegraphy. The experiments of the author confirm and extend the tests made by Kiebitz and others, and would appear to indicate that horizontal antennas placed very near the earth's surface exhibit efficiencies both as receiving and radiating systems which are comparable with a simple vertical aerial. The data also appear to indicate that when utilizing such low horizontal antennas either as absorbing or radiating systems the free end of the aerial should point in the direction of the second station. This appears not to conform to Marconi's law of horizontal antennas and may be due to local topographical conditions. The fact that energy was intercepted and radiated when both ends of the horizontal systems were grounded would appear to indicate that we are dealing in such cases with what Sommerfeld calls a surface wave, as more or less distinct from a space wave.—*Phys. Review,* April, 1914.

Wireless Telegraphy Waves.—H. BARKHAUSEN.—An article on the propagation of electromagnetic waves in wireless telegraphy. The comparison of the results of experiments and theory shows complete agreement as long as the distance between transmitting and receiving stations is short so that the curvature of the earth need not be taken into consideration. For long distances the propagation of the waves seems to take place by two entirely different methods. First, normally the refraction of the waves which can be calculated from theory brings only a weak wave to the receiver and the amount transmitted is smaller the shorter the wave-length. Wave transmission during the day occurs in this way. Secondly, irregularities in the atmosphere may produce reflections in the air so that a much larger amount of wave energy comes to the receiver, and this amount is independent of the wave-length. This would explain the results obtained with transmission during night.—*Elek. Zeit.,* April 16, 1914.

Miscellaneous

German Electrical Industries in 1913.—A continuation of the long series of reviews of the present status of the different branches of electrical engineering in Germany in 1913. Adolf Schnee discusses the applications of electricity in medicine and therapeutics, while Wehland discusses electric signaling.—*Elek. Zeit.,* April 9, 1914.

German Electrical Industries.—The conclusion of the long illustrated serial on the status of the various branches of German electrical industries in 1913. W. Schneider deals with telegraphy and telephony over wires. H. Thurn with wireless telegraphy and telephony.—*Elek. Zeit.,* April 16, 1914.

Electrical Terms.—A list of the electrical terms about which an international agreement was reached at the Berlin convention of the International Electrotechnical Commission in September, 1913. All the terms are given in German, French and English.—*Elek. Zeit.,* April 16, 1914.

Book Reviews

GRAPHS IN A CABLE-SHIP DRUM ROOM. By Edward Raymond-Barker. London, England: H. Alabaster, Gatehouse & Company. 43 pages, 10 illus. Price, 2s. 6d.

In this little publication are collected and collated a series of articles published by the author in the London *Electrical Review* in the early part of 1913. Mr. Raymond-Barker is an advocate of graphical engineering methods, as his publications well attest. This latest publication is in the same direction. We think that most engineers will agree with him. Graph methods are capable of being made wonderfully swift and reliable. There are few situations where time may be more precious in forming a judgment than in a cable steamer. The pamphlet indicates a number of graphs relating to drum constants, slack and other quantitative details of a cable engineer's work. A few excellent photographs of scenes on cable ships illustrate the text. in an interesting manner.

THE PRICE OF INEFFICIENCY. By Frank Koester. New York: Sturgis & Walton Company. 440 pages. Price, $2.

This interesting and instructive book brings home with forcibly illustrative argument the fearful waste going on all around, in the abolition of which lies the chief hope of abatement of continuously rising prices and increasing cost of living. The author calls attention to administrative waste, to the waste of human life, and to the by-products of inefficiency. He shows that a government, like that of Germany, which is of a somewhat military character is certainly more economical than one based on shifting conditions and not infrequently headed by shiftless men. How important a work of this character is at this period anyone may judge for himself. Consider the cost of conducting a business office. The waste of materials would often take care of a business of twice the size, and the time wasted in doing work twice, both in shops and offices, would allow for a volume of business of double the magnitude. Thus the difference between success and failure lies in the ability to reduce waste. Mr. Koester's book will be of value to all who read it.

SWITCHBOARD, SWITCHING, PROTECTIVE APPARATUS. By C. C. Adams. Chicago: American School of Correspondence. 120 pages, 72 illus. Price, $1.

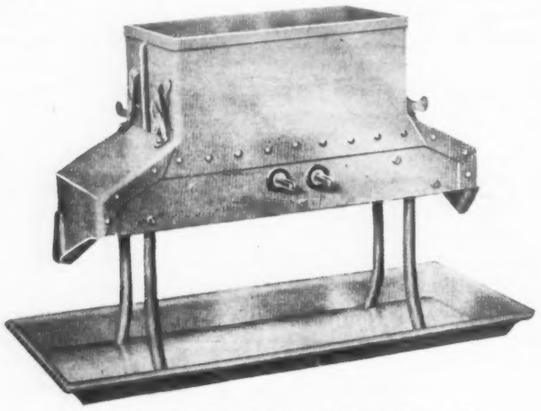
This book contains brief descriptions of the more or less standard types of switchboard. Prominence is naturally given to the latest American practice, although some European types of switchgear are referred to. The "ironclad" type has, indeed, not made very much headway in Europe, and it is doubtful if its few advocates will ever convince the average engineer that the advantage gained by the complete inclosure of all high-tension metalwork may reasonably be set against the fairly obvious disadvantages of this system. Had the author wished to give his readers an insight into the methods of those countries whose practice differs from that of our own leading manufacturers, he would have referred to the European practice of using enameled slate panels, the appearance of which is undoubtedly attractive. It should, however, be borne in mind that the book is probably not intended for the use of designers or experienced engineers. For the student and the operating engineer in charge of electrical machinery it will probably prove to be a very instructive and useful little volume.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Electric Heating Device for Sealing Wax

To satisfy the demand of certain manufacturers for an apparatus which will give a continuous and reliable supply of hot sealing wax of uniform amount and consistency, the firm Simplex Conduits, Ltd., Birmingham,



APPARATUS FOR HEATING SEALING WAX

Eng., has developed the sealing-wax heater shown herewith. The size of the wax container is 6 in. long by 3 in. wide by 2.25 in. deep, while the size of the tray is 12 in. by 5 in. The heating unit for the wax takes 200 watts. The sealing wax is placed in the inner receptacle and is allowed to run over two slopes provided at either end, which are also heated to prevent the wax from cooling. As a result the wax can be picked up by the flaps of the parcels to be sealed. Where it is necessary to use an ordinary seal impress, the wax can be run down the slopes, which are so shaped at the bottom as to allow the wax to drop off. The amount flowing out of the central chamber can be regulated by opening or closing the two apertures with the small shutters provided. Any excess wax is caught in the tray upon which the heater stands and is used again. The device is of black-enameled iron and is double-ended, thus enabling two persons to work with it simultaneously.

Distributing Transformers

Distributing transformers rated at from 1 kw to 75 kw are being placed on the market by the Moloney Electric Company, St. Louis, Mo. In the illustration is shown one of these transformers built in ratings of from 20 kw to 75 kw. The tank of this transformer is of corrugated cast iron and is provided with a large radiating surface, thus insuring a low temperature rise. All of these distributing transformers are equipped with terminal boards. The lead wires pass through a heavy porcelain block before entering the terminal board. Compensating taps are furnished in 1.25 per cent steps from 1.25 per cent to 10 per cent. With each transformer ranging in rating from 1 kw to 50 kw there is provided a brass name-plate which serves to show how the different taps can be connected.

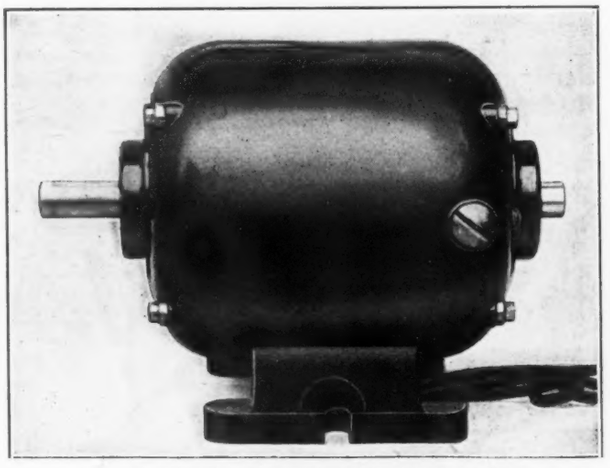
Transformers for outdoor service designed for pressures of from 22,000 volts to 66,000 volts are also being made by the above company. These transformers are of the self-cooling type and are built in ratings of from

TRANSFORMER WITH CORRUGATED CAST-IRON CASE

10 kw to 2000 kw. The smaller transformers are inclosed in straight steel cases, while the larger have corrugated steel cases.

Cycle-Car Lighting Outfit

Apparatus for lighting small cars which have a lamp load of not more than 5 amp is being placed on the market by the Ward Leonard Electric Company, Bronxville, N. Y. This outfit is identical in construction with



DYNAMO FOR CYCLE-CAR LIGHTING OUTFIT

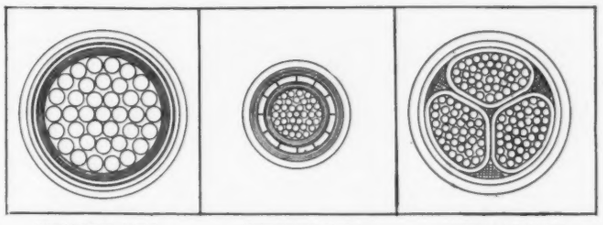
that for the larger cars with a lighting load approximating 9.5 amp, and the same method of operation is employed. The generator delivers 6 amp at 1800 r.p.m., and it weighs less than 9 lb. As can be seen by com-

paring with the scale in the illustration, the machine is very small. A separate constant-current control system is used. This controller also embodies an automatic battery switch.

Insulated Cables of Aluminum

BY E. V. PANNELL

For several years the street-railway system of Paris has been operating with low-tension feeder cables of aluminum. This use of this material has been attended with such very successful results that when considerable extensions were made to the system in 1913 aluminum was again utilized as the conductor, realizing a net economy of about 8 per cent on the cost of copper cables. The cables in question are mainly of the paper-insulated, lead-covered and armored type laid in channels under the sidewalk. Developments in this direction in Europe have not, however, been confined to Paris, for in a paper read by Mr. d'Hoop, of the Brussels (Belgium) street-railway system, about the end of 1912, the author reported that eight different street-railway companies in France, Germany, Switzerland,



SINGLE-CORE CABLE	CONCENTRIC CABLE	THREE-CORE CABLE
Area....1,650,000 circ. mils	Area....2x320,000 circ. mils	Area....3x610,000 circ. mils
Thickness insulation.0.118 in.	Thickness insulation.0.10 in.	Thickness insulation.0.125 in.
Thickness lead....2x0.06 in.	Thickness lead.....0.09 in.	Thickness lead.....0.125 in.
Resin oil between lead sheaths, jute and compound.....0.09 in.		

FIG. 1—LOW-TENSION INSULATED CABLES WITH ALUMINUM CORES

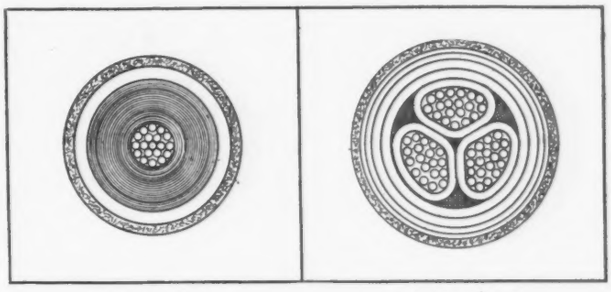
Belgium and Denmark were using insulated cables of aluminum. In addition to these, several English traction and utility corporations have installed underground aluminum cables for almost every type of service.

Not only has the simple single-core cable been manufactured in aluminum but also double and triple concentric cables and the interesting clover-leaf form of three-core conductor for pressures from 600 volts up to 6600 volts have also been used. Quite recently a quantity of the latter was sold at a price which showed a saving over copper, with the heavier metal at a base price of about 17 cents per lb. A few typical aluminum cables for low-voltage high-voltage work are shown in Figs. 1 and 2 respectively. These are reproduced merely to show that practically every form of cable has been manufactured in aluminum and that the metal is by no means restricted to heavy low-tension cables, although these form by far the larger proportion of the aluminum cables in use. The test of economy is, however, the true one wherever a new departure is entered upon, and it is obvious that aluminum cables can compete with copper only where the relative prices of the two metals make aluminum worth while. Before October, 1913, the price of aluminum in the United States was not such as to make it advantageous for insulated cables, except when the copper market was abnormally high. Under present circumstances, however, the light metal is quoted at prices which show about 25 per cent economy over copper, considering the wire base to be about the average figure for the latter metal. During the year 1913 the average monthly price of electrolytic-copper wire billets, f.o.b. New York, was 15½ cents per lb. Allowing a fair differential for rolling and drawing, this represents a wire base of 17 cents per lb. Aluminum wire can be bought at from 24 to 25 cents per lb. Taking the mean of 24 cents, the relation between the costs of the bare wire will be:

	Cents
Aluminum, 1 lb. at 24¼ cents	24¼
Copper, 2 lb. at 17 cents	34
Difference	9¼

The above computation makes allowance for the physical properties of the metals. Copper has three and a third times the weight of aluminum, but the latter has only 60 per cent of the conductivity of copper; hence the ratio of weight for a wire of given resistance per foot is slightly more than two to one in favor of aluminum.

Under the above conditions it remains to be seen to what exent the saving of 9.5 cents per lb. will be taken up by the cost of insulating and covering with lead the larger diameters of aluminum cables. In Fig. 3 is



SINGLE-CORE CABLE	THREE-CORE CABLE
Area.....198,000 circ. mils	Area.....3x248,000 circ. mils
Thickness paper dielectric.....0.512 in.	Thickness paper dielectric.....0.197 in.
Thickness lead covering.....0.138 in.	Thickness lead covering.....0.118 in.
Thickness jute serving.....0.118 in.	Thickness steel-tape armoring.....0.120 in.
Voltage.....30,000	Thickness jute serving.....0.090 in.
	Voltage.....6600

FIG. 2—HIGH-TENSION PAPER-INSULATED CABLES WITH ALUMINUM CORES

shown the cost of stranding, insulating and lead-covering cables for pressures of up to 660 volts. Allowance has been made for material (taking lead at 4 cents per lb.), labor and a reasonable profit. Figuring out a concrete instance—that of a 600,000-circ. mil copper cable—the results shown in the accompanying table are ar-

COMPARATIVE DATA ON COPPER AND ALUMINUM CABLES

	Copper	Aluminum
Size, circ. mil	600,000	1,000,000
Number of strands	61	91
Diameter each wire, inches	0.099	0.105
Diameter core, inches	0.893	1.150
Thickness dielectric, inches	0.100	0.120
Thickness lead, inches	0.100	0.120
Outside diameter, inches	1.293	1.630
Weight core per foot, pounds	1.850	0.925
Base price	$0.170	$0.245
Cost core per foot	0.314	0.227
Cost insulation and manufacture	0.160	0.230
Total cost of cable	0.474	0.457

rived at. On the aluminum cable in this instance a saving of about $90 per mile is effected. This is, however, considerably less than the economy which frequently results from using aluminum. Larger sizes of cables such as are employed for railway feeders are cheaper to manufacture and show a relatively larger profit when made of aluminum. The price of copper, too, is by no means always as low as the figure assumed in the preceding calculation, so that according to the market

aluminum cables will show a greater or less saving than that indicated above. As a writer in the *American Metal Market* (March 2, 1914, page 4) has pointed out, the growth of the electrical industries is calling for increased quantities of copper far out of proportion to the production of the metal, and unless a substitute is forthcoming there is reason to expect sooner or later considerable advance in the present market quotations for electrolytic metal.

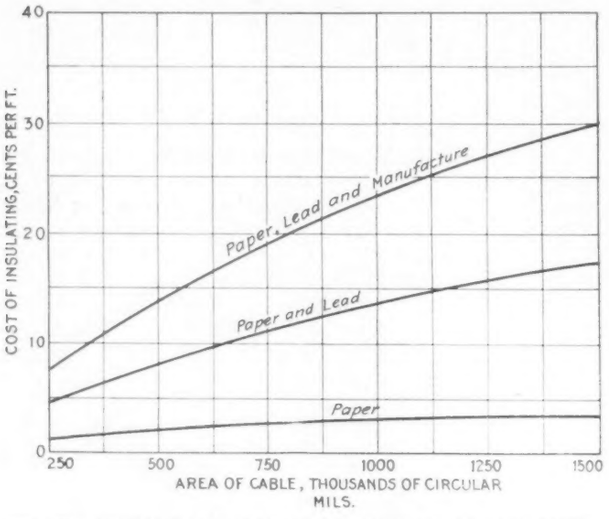


FIG. 3—APPROXIMATE COSTS FOR INSULATING AND COVERING LOW-TENSION CABLES

The subject of aluminum and copper cables was admirably dealt with by Mr. B. Welbourn in a paper read before the London Institute of Mining Engineers in June, 1913. His conclusions were based upon extensive experience in the manufacture and sale of aluminum and copper cables, and the diagram Fig. 5 has been reproduced from figures given by Mr. Welbourn. This shows that for a particular size of cable (equivalent to 380,000 circ. mil copper) aluminum begins to be cheaper when the market price is 24½ cents per lb., and at the average figure aluminum cables show 8 per cent economy.

The foregoing has perhaps sufficed to show that for ordinary low-tension paper-lead cables aluminum is a conductor deserving of consideration from the economic standpoint. In the field of extra high-tension work, however, the case is different; here aluminum possessses technical advantages. Experience with overhead high-tension lines goes to show that there is a ratio of voltage to conductor diameter which cannot be exceeded without giving rise to corona loss. A similar phenomenon takes place with underground cables, and aluminum was chosen for the core of the 30,000-volt cable shown in Fig. 2 for this reason. In any high-

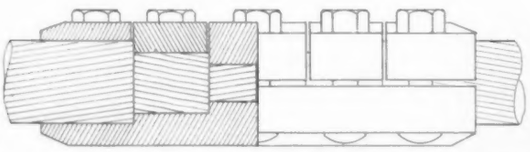


FIG. 4—STEPPED CLAMP EMPLOYED FOR THROUGH JOINTS

tension cable of this kind the steepness of the potential gradient in the dielectric is given by the formula

$$\frac{V}{r \log \frac{r+d}{r}}$$

where V = effective voltage,
r = radius of core,
d = thickness of dielectric

Naturally, if r is increased d may be diminished and the same potential gradient maintained. Aluminum is effective in that it has a value of r which is always 30

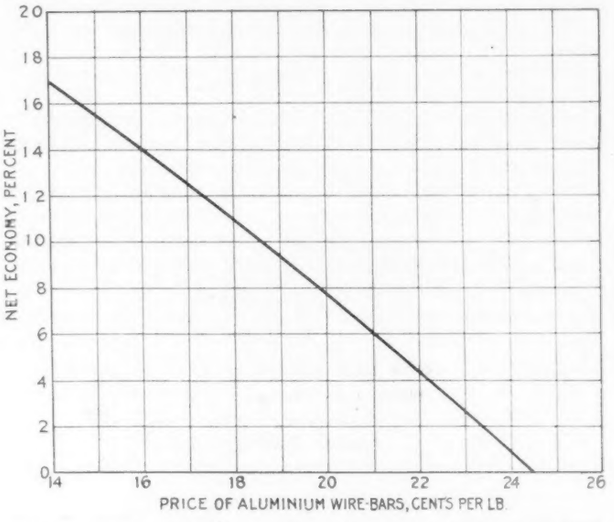


FIG. 5—WELBOURNE'S VALUES FOR NET SAVING EFFECTED BE ALUMINUM CABLES

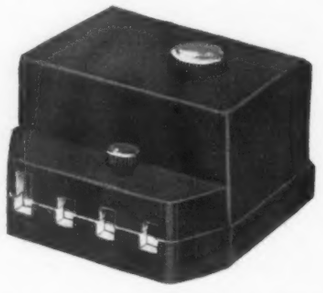
per cent in excess of copper, so that it necessitates less insulation and a correspondingly cheaper cable.

The practical problems in connection with aluminum are mainly those of making joints. No really satisfactory solder being available, it becomes necessary to employ clamp-joints. The facility with which surfaces of aluminum bite into one another renders these particularly effective, however, and tests made after several years' service demonstrate that this type of connection is no more liable to deterioration than a soldered one. The energy supply for some of the most important suburban railroads in the vicinity of Paris is fed through clamp-joints of the simplest form with perfect satisfaction.

The British Aluminium Company has recently developed an improved type of stepped clamp. A typical pattern is shown in Fig. 4 and represents one of the most satisfactory forms at present in use. The contact resistance is reduced to the minimum, and the size and disposition of the bolts render the joint particularly quick and easy to apply.

Controller for Automobile-Lighting Generator

An automatic controller for low-voltage automobile-lighting generators is being manufactured by the Ward Leonard Electric Company, Bronxville, N. Y. This controller, the manufacturers claim, gives a constant ampere control without arcing at any of its parts. The device is small and embodies an automatic voltage cut-out. This cut-out connects to and disconnects from the battery. This controller, which is illustrated herewith, permits the use of a plain shunt-wound generator.



Internal-Starter Motor

An alternating-current motor with a starting device mounted in a ring, as shown in Fig. 1, has been developed by Fairbanks, Morse & Company, Chicago, Ill. This ring is keyed to the rotor shaft and is inclosed in the motor frame. Within this ring are mounted three insulated iron tubes, each tube containing a pile of carbon disks at the outer end of which is a contact terminal connected to one of the phase windings of the rotor. The inner ends of the three piles are connected together. The three carbon piles, therefore, form a Y connection, and the secondary or rotor circuit is closed through a resistor the resistance of which can be varied by the application of pressure to the inner ends of the piles.

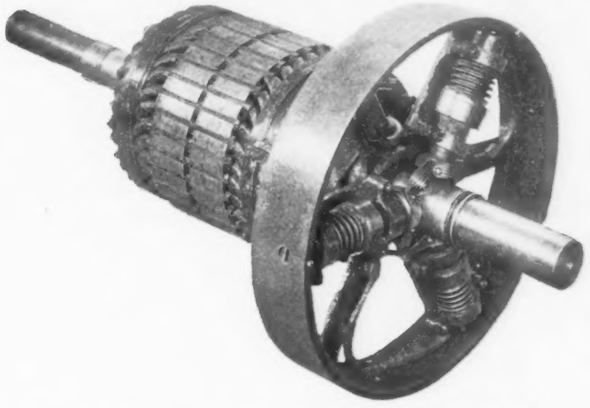


FIG. 1—ROTOR FOR INTERNAL-STARTER MOTOR

The insulated tubes which inclose the disks are free to move radially in their guides, and their motion is opposed by a spiral spring, which surrounds them on the outside. The total motion of the tube does not exceed 1/16 in., but affords a wide range of resistance, which, when the disks are fully compressed, is reduced practically to zero. When the primary circuit is closed by the main switch the motor starts with a comparatively high resistance in the rotor winding, due to lack of pressure on the disks; but as it speeds up the weight of the inclosing tubes compresses the disks and gradually reduces the resistance, thus giving a gradual increase in speed and increase in power as the motor accelerates.

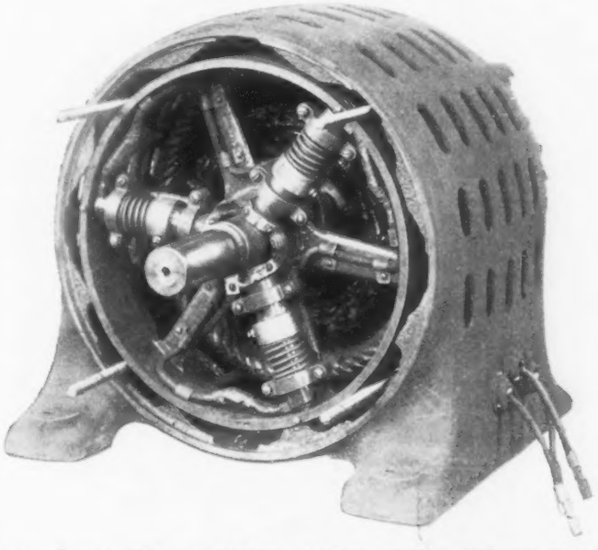


FIG. 2—INTERNAL-STARTER MOTOR WITH ONE BEARING BRACKET REMOVED

This internal-starter motor is designed for use on two-phase and three-phase circuits, and it is built in two types, one being adapted to operate on electric-lighting circuits where the starting will not impair the lighting service and the other for intermittent work. The latter design is especially suited for service in connection with elevators.

Electric Power Table

In every modern home there are many household appliances that are or could be driven by an electric motor. Sewing machines, washing machines, ice-cream freezers and many other devices can now be operated economically by electricity. A simple portable apparatus that makes a separate motor for each appliance unnecessary has been designed particularly for use in the home by the Federal Sign System (Electric), Chicago, Ill. The power table, as it is called, occupies an area 18 in. by 26 in. in dimensions, and it is 30 in. in height.

Energy is supplied through a 10-ft. connecting cord securely fastened to the table and fitted with a detachable plug for connection with the nearest lamp socket. All gears are inclosed. A snap switch is conveniently placed on the right-hand side of the front of the table. A ¼-hp motor is suspended from a hinged platform so that it and the power shaft can be lowered and made to disappear below the table top when not in use in a manner similar to the disappearing head on sewing machines. When closed the opening is covered by a sliding panel, leaving a smooth top of polished oak which can be used as an ordinary table. When the motor is in use the panel slips down into the table.

ELECTRIC POWER TABLE

Various devices have been designed for use in connection with this table. These include a bread mixer, a cake mixer, a coffee grinder, a food chopper, an ice-cream freezer, an egg beater, a vegetable slicer, a food grater, a knife sharpener and a knife polisher.

Disk-Stove Chafing-Dish Set

A combination disk stove and chafing dish similar to the ordinary alcohol type of chafing dish except that it has an electric disk stove in direct contact with the water pan, instead of an alcohol heater, is shown herewith. The complete set consists of a stand, a disk stove, a three-heat switch, an attachment plug, a water pan, a food pan, and a cover. The water pan, the food pan

and the cover are the same as those used with alcohol-heated chafing dishes.

The heater consists of a steel disk inside of which the heating element is sealed and protected from oxidation. A dead-air space between the heater and the bottom

ELECTRIC CHAFING DISH

of the stove casing acts as a heat insulator, preventing the loss of heat downward, so that practically all of the heat is thrown upward, where it is wanted. An indicating switch controls the temperature. The high heat is ordinarily used to bring the chafing dish quickly to the desired temperature. The low heat will keep water boiling after the boiling point is once reached; it is also useful for keeping the food warm. The medium heat is the highest that is usually needed for general cooking purposes.

With the feet of the disk stove reversed as shown the outfit is a chafing dish capable of cooking anything in it that can be cooked in an alcohol chafing dish. The disk stove can be used separately for any purpose for which a single-burner gas stove can be used, such as frying, grilling, making coffee, and various similar operations.

This disk-stove chafing-dish set is being made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Small Direct-Current and Alternating-Current Motors

Fractional-horse-power motors of the clutch and clutchless types rated at from 1/40 hp to ¼ hp for alternating-current and direct-current circuits are being placed on the market by the Menominee Electric Manufacturing Company, Menominee, Mich. The

FRACTIONAL-HORSE-POWER MOTORS

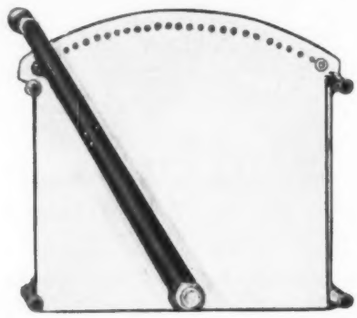
frames of these motors are of cast iron and are finished with two coats of glossy-black baking enamel.

The stator of the alternating-current motors is built up of sheet-steel punchings and the rotor of thin Norway iron sheets. There are no windings on the rotor. Lubrication is by oil cup and wick oiler, return grooves being provided to prevent oil throwing. Motors designed for operating pianos are equipped with a special tube oiler in addition to the wick oiler. Motors of less than ⅙ hp are of the clutchless type and those of more than ⅙ hp are provided with a clutch.

The frame of the direct-current motors and the poles are cast in one piece. These motors are tested under 50 per cent overload and they will carry 100 per cent overload, the manufacturers claim, for short periods without injury.

Automobile Battery-Charging Rheostat

An inexpensive battery-charging rheostat for gasoline automobiles is being placed on the market by the Ward Leonard Electric Company, Bronxville, N. Y. The

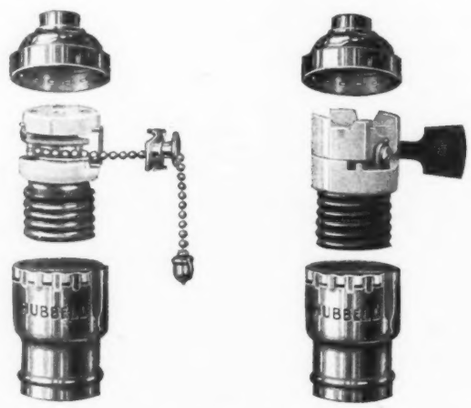


RHEOSTAT FOR GASOLINE AUTOMOBILES

device, which is illustrated herewith, is 11 in. square and 3.5 in. high. It will take care of from one to four cells at a charging rate of 8 amp.

Snap-Shell Sockets

The pull socket and key socket illustrated herewith are equipped with a shell and cap which not only can be fitted together easily but can be as readily detached. The top of the shell is fluted and between the flutes are small cut-outs. There are nineteen different projections in the cap which fit into a corresponding number



FIGS. 1 AND 2—PULL AND KEY SOCKETS

of slots in the shell, thus insuring absolute security. By means of this arrangement the sockets can be so placed on the fixture that the chain eyelet or key can be at any desired position. These sockets are manufactured by Harvey Hubbell, Inc., Bridgeport, Conn.

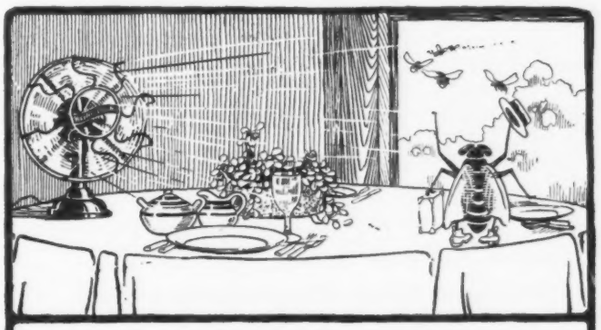
Jobber, Dealer and Contractor

Co-operative Electric Show in Tulsa

In conjunction with electrical dealers and contractors, the Public Service Company of Oklahoma gave an electric show in the Hotel Tulsa, Tulsa, Okla., during the week ended May 16. Domestic appliances in variety were exhibited and demonstrated in the grill room of the hotel. Printed invitations were sent to all of the electric-service company's customers and prospective customers. The dealers and contractors co-operating were the Deshon-Davison Company, Dodge Electric Company, Electric Supply Company and Tulsa Electric & Construction Company.

Jobber's Fan-Selling Campaign

Realizing that the obligation to its customers goes beyond the mere supplying of goods and stereotyped catalogs describing its products, the Western Electric Company has inaugurated a selling campaign which includes the education of the dealers in methods of selling and window decorating, extensive advertising in various newspapers and periodicals, and supplying the dealer with advertising helps of his own. In other words, the company undertakes everything in the process of selling a fan except consummating the actual sale of the article itself. An elaborate collection of circulars, posters and booklets has been prepared, which are being sent out broadcast to the trade.



This Is No Place for Me!

These people have bought a

Western Electric

Fan

Wherever there's a Western Electric fan flies are conspicuous by their absence.

In the dining room, kitchen, restaurant or store a Western Electric fan effectively rids you of these little pests.

For the store—a ceiling fan outside the entrance is better than a screen door. It affords an unobstructed view of the interior and at the same time effectively keeps out the flies.

An 8-inch desk fan on the table will give you a meal in comfort.

This type costs only ¼ of a cent an hour to run.

Every fan has a felt covered base. Can be used on the table, mantel, book case, without scratching.

Come in to-day and let us show you the new fans we've just received.

(This space for your name and address)

FIG. 1—SAMPLE FAN-SELLING ADVERTISEMENT

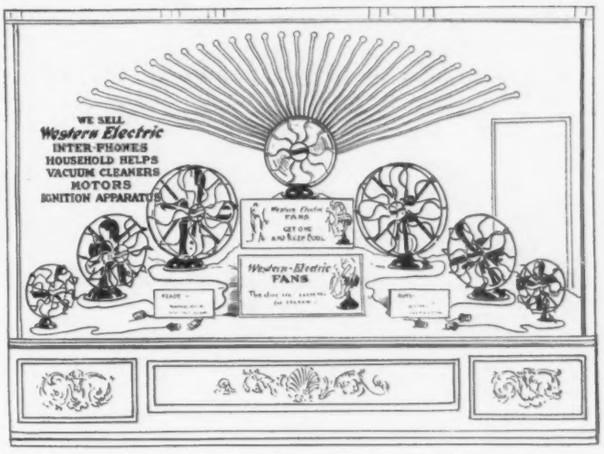


FIG. 2—TYPICAL WINDOW DISPLAY

Instead of the usual expensive catalog, a forty-eight-page booklet has been printed giving price lists and detailed descriptions of each type of fan. This is for the dealer. An attractively illustrated folder, describing briefly several fans, is provided for the buyer. This, however, contains no prices, as these are fixed by the dealer. Another folder, describing the various advertising helps provided, has been prepared for the dealer. Among these are newspaper advertisements, lantern slides for moving-picture shows, display cards, mailing folders and material for decorating windows.

Electrotypes of all the advertisements, one of which is shown in Fig. 1, are provided. One of the stock window displays is illustrated in Fig. 2. The material for this display consists of ribbon to attach to the fan shown in the center of the group, stickers to fasten the ribbons to the window glass, display cards and signs, artificial snow, and a decalcomania window sign shown on the window glass at the left. A circular giving complete instructions for arranging the fans and the decorations is also supplied.

Electrical Contractors Preparing for Big National Convention

It is believed that the forthcoming annual convention of the National Electrical Contractors' Association of the United States, to be held at the Hotel Cadillac, Detroit, on July 14-18, will be the most successful in the history of the organization. Meetings of the board of directors and executive committee will be held on Tuesday, July 14. The morning session of Wednesday, July 15, will be open and talks will be made by a number of men of prominence in the electrical industry. The afternoon session of Wednesday and all sessions of Thursday will be closed sessions, for members only. Friday, July 17, is reserved for outing day. If any business remains to be wound up, it will be taken up on Saturday. Otherwise this day will be used for the meetings of the board of directors and executive committee. The banquet will be held on Thursday night, and one evening will be set aside for the rejuvenation and joviation of the Jovian Order. Exhibits will be made by electrical manufacturers, and it is already certain that there will be displays from fifteen or more concerns. Mr. Ernest Freeman, 538 South Dearborn Street, Chicago, is president of the association.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Electric Truck Business Booms.—Since the beginning of the year 1914 twenty electric trucks have been sold by the General Vehicle Company, Inc., to Chicago breweries. Practically all of these vehicles are heavy units.

Canadian Factory for Lighting Standards.—The Union Metal Manufacturing Company's business in Canada has grown to such an extent that it has undertaken to build a new plant at Galt, Ont., thus saving a 30 per cent duty which is imposed on standards imported from the United States.

Insulated-Cable Business Fair.—The Okonite Company, 253 Broadway, New York, is finding business not so good as it was at this time last year. Conditions, however, are not alarming, and the company is evincing a spirit of optimism. The springtime is said to be usually the busiest time in the cable and wire industry. The Okonite Company gets most of its orders from the North and the West, relatively few coming from below the Mason and Dixon line.

Waterwheels for South America.—The Pelton Water Wheel Company of San Francisco, Cal., is receiving a number of orders for small-sized units from South American republics, and the amount of business done in this locality during the past year is said to be greater than that for the year before. The business in the United States at the present time is very slack. This is due, it is declared, to the unrest resulting from pending legislation on hydraulic developments.

Fire in Transformer Factory.—On May 2 part of the plant of the Pittsburgh Transformer Company was destroyed by fire. The shipping department, one of the storerooms, the carpenter shop and the tank factory were damaged most. The loss is estimated at about $50,000. Fortunately few of the records and none of the drawings or designs were destroyed, and accordingly little delay or inconvenience to customers resulted. A temporary shipping room was put in operation two days after the fire, and shipments have been made regularly since then.

Electric Washing Machines for the Chinaman.—The Public Service Company of New Jersey is endeavoring to convince the Chinese laundrymen that electrically operated machines should be in every laundry, and it is the intention of the company to employ a Chinese salesman to solicit business. A circular has been prepared by the Western Electric Company for the Public Service Company which is printed in both English and Chinese. Should this selling project meet with the success that is expected of it the Western Electric Company intends to develop this business in other localities, carrying on an educational campaign especially for the Chinaman's benefit.

Sales of Recording Instruments.—The Bristol Company, Waterbury, Conn., has recently sold forty-eight recording voltmeters to the Public Service Company of New Jersey, 100 instruments of the same type to a Canada buyer, and thirty-eight recording thermometers to a New York City concern. These sales are in addition to the routine business, which is reported to be very good. This company has developed a new hub for holding the dial plate of its recording instruments. The hole of this hub is eccentrically drilled, and in screwing on the cap a quarter turn is sufficient to bring it home. Fumbling and shifting of the cap to find the thread is, therefore, unnecessary.

Plant of General Insulate Company Damaged by Fire.—On April 25 a fire almost destroyed the power plant, the finishing rooms and part of the press rooms and machine shops of the General Insulate Company, 1008 Atlantic Avenue, Brooklyn, N. Y. Continual rainfall for three days following the fire made it almost impossible to do any work on the unroofed main building. However, within four days after the fire an inventory of the plant, covering 2700 different classifications, had been made, and on the succeeding Monday temporary die shops and finishing rooms were put in working order. Ten days after the fire the company was making shipments and the presses were working again. Reconstruction work has been started on the old plant.

Railway Motors for Baltimore.—The United Railways & Electric Company, Baltimore, Md., has ordered from the General Electric Company eighty-five four-motor equipments, which will be installed on the new cars being built by the J. G. Brill Company. The cars are of the double-end type and are equipped with improved cylinder-type controllers. The motors are of the split-frame, commutating-pole, positive-ventilated type and have a nominal rating of 33 hp on 500 volts and 40 hp on 600 volts. It is interesting to note that this additional traction equipment has been purchased primarily to provide adequate service during the centennial celebration of the writing of "The Star-Spangled Banner," which takes place in Baltimore during the week beginning Sept. 7. The contract with the General Electric Company also includes additional substation apparatus, comprising a 2000-kw, twenty-five-cycle, six-phase, compound-wound rotary converter, three 750-kva transformers, and switchboard panels.

Vacuum-Cleaner Engineer.—The Eureka Sales Company, 131 West Forty-second Street, New York, dealer in vacuum cleaners, employs an expert who acts in an advisory capacity to prospective buyers. This man studies the needs of each customer and advises what kind of cleaner is best suited for his particular purposes. He is also prepared to work with the architect where large vacuum-cleaning installations are to be made. This company finds business very good. It has been found that the largest number of sales are made in October and May of each year. The number of sales of the Eureka vacuum cleaner for April of this year is ahead of that of May last year, and it is safe to conclude, therefore, that the number of sales for May will be greater than that for the same month in 1913. The number of sales of an improved cleaner, known as the Eureka, type C machine, placed on the market March 1, 1914, was greater during April than that of all the Eureka machines sold in May of last year.

Prominent Electrical Men Entertained in Cleveland.—On Wednesday noon, May 6, Mr. George H. Kelly, secretary of the Baker Motor Vehicle Company, of Cleveland, Ohio, was host at the Union Club to a gathering of twelve men well known throughout the country for their connections in the electrical business. The guest of honor was Mr. Frank W. Smith, president of the Electric Vehicle Association of America, who was visiting the Baker factory. After inspecting the Baker plant Mr. Smith visited the leading garages of the city. Other guests at Mr. Kelly's lunch were Mr. S. E. Doane, of the National Electric Light Association; Mr. L. P. Sawyer, manager Buckeye Lamp Company; Mr. C. L. F. Wieber, president Rauch & Lang Carriage Company; Mr. George S. Milner, general manager Erner Electric Company; Mr. Mathias Turner, commercial agent Illuminating Company; Mr. T. P. Cagwin, commercial manager Cleveland Telephone Company; Mr. H. B. Gay, manager Cleveland office of the Electric Storage Battery Company; Mr. George D. Smith, district sales agent of the General Vehicle Company, New York; Mr. Ayers, manager truck department of the General Motors Company, and Mr. Hayden Eames, president Standard Electric Car Manufacturing Company.

Increasing Home Comfort by Means of Electricity.—On May 2 Mr. Arthur W. Hartigan, of the Western Electric Company, read a paper entitled "How to Increase Your Convenience and Comfort in the Home" at the home builders' exposition in the Craftsman Building, New York. Mr. Hartigan pleaded for the development of a higher percentage of efficiency in the home and declared that the adoption of electric appliances would aid materially in its attainment. The speaker gave data showing that vacuum cleaners, washing machines and electric heating and cooking devices were real and necessary factors in elevating the standard of living.

Electrical Equipment for Industrial Concerns.—The increasing popularity and usefulness of electrical equipment among the various industrial concerns is shown by the numerous orders made recently for new installations or for additions to electrical apparatus already in operation. Among these concerns is John P. Squire & Company, Boston, Mass., who will add to the electrical equipment in their plant at Cambridge, Mass., a 300-kw alternating-current generator, three 40-kw transformers, a Tirrill regulator and a six-panel switchboard. The Michigan Limestone & Chemical Company, Calcite, Mich., will also place in operation in its plant at Rogers City, Mich., a 1250-kva Curtis turbo-generator with a 7-kw motor-generator exciter set, a 200-hp induction motor, ten motors ranging from 20 hp to 75 hp, transformers and a switchboard. The Edward Ford Plate Glass Company, Toledo, Ohio, will add to the equipment of its plant a 13-ton, 42-in.-gage electric industrial locomotive and transfer-car equipment. The Braender Rubber & Tire Company, Rutherford, N. J., will add to its equipment five 100-hp induction motors. The Hebron Fire & Pressed Brick Company, Hebron, N. D., has arranged to install electric equipment consisting of a 300-kw Curtis turbo-generator and a 5-kw exciter, a 10-kva transformer, a switchboard and nineteen motors ranging from 7.5 hp to 50 hp in rating. The J. C. Hubinger Brothers Company, Keokuk, Ia., will add to its plant a 1270-hp synchronous motor with an 18-kw exciter and a switchboard. The Grand Rapids Plaster Company, Grand Rapids, Mich., will add a 35-hp and five 25-hp induction motors to its equipment. The Quaker Oats Company, Chicago, Ill., will add to its plant three 75-hp and two 100-hp motors. The Oneida Community, Ltd., Oneida, N. Y., is installing considerable electric equipment in its plant at Sherrill, N. Y., which includes 104 motors ranging from 3 hp to 20 hp in rating. The Robert Gair Company, Brooklyn, N. Y., is equipping its printing plant for electric drive, and has arranged to install fifty-seven additional motors ranging from 0.5 hp to 3.5 hp in rating, with controllers and accessories. The equipment for the above companies is to be supplied by the General Electric Company.

NEW YORK METAL MARKET PRICES

	May 5		May 12	
Copper	Bid	Asked	Bid	Asked
Standard spot*	13.40	14.00	13.50	14.00
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard spot*	63 7 6		63 3 9	
Prime Lake	14.37½	to 14.62½	14.37½	to 14.50
Electrolytic	14.10	to 14.20	14.00	to 14.10
Casting	14.05	to 14.15	13.90	to 14.00
Copper wire base	15.25	to 15.50	15.25	to .....
Lead		3.90		3.90
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter		7.00		7.00
Spelter, spot	5.05	to 5.15	5.15	to 5.25
Tin, spot	33.05	to 33.15	34.37½	to 34.62½
Aluminum:				
Prompt delivery	17.75	to 18.00	17.87½	to 18.12½
Future	17.75	to 18.00	17.75	to 18.00

*OLD METALS

Heavy copper and wire	12.87½	12.87½
Brass, heavy	8.62½	8.62½
Brass, light	7.50	7.50
Lead, heavy	3.90	3.90
Zinc, scrap	4.15	4.15

*COPPER EXPORTS

Total tons to May 5 14,141

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

General Electric Directors.—At the annual meeting of the stockholders of the General Electric Company, held at Schenectady, N. Y., on May 12, the retiring directors were re-elected and Mr. Benjamin Strong, Jr., was added to the board.

Electric Bond & Share Company Results.—The financial statement of the Electric Bond & Share Company as of Dec. 31, 1913, shows investments of $9,313,478, of which $6,689,350 represents stock and $2,624,128 represents bonds and coupon notes. Syndicate holdings, underwritings and advances amount to $4,187,704. The surplus was $3,187,714 and reserves were $101,000.

Officers Elected for American Water Works & Electric Company.—At a recent meeting of the directors of the American Water Works & Electric Company the following were elected permanent officers: President, H. Hobart Porter; vice-president and treasurer, Stuart H. Patterson; secretary, Harry E. Towle; assistant to the president, J. H. Furdy. The following were chosen as members of the executive committee: H. Hobart Porter, Samuel Insull, Guy E. Tripp, T. H. Wiggin, James D. Mortimer and H. H. Pierce. The company's executive offices will be in New York City.

American Light & Traction Company Earnings.—The statement of the American Light & Traction Company for the twelve months ended March 31, 1914, shows earnings on stocks of subsidiary companies owned by that company of $3,712,368, as compared with $3,748,841 in the preceding fiscal year. Miscellaneous earnings were $710,398 as compared with $571,529. Gross earnings, therefore, were $4,422,766 as compared with $4,320,370. Expenses amounted to $130,882 in the 1914 fiscal year and to $117,489 in the 1913 fiscal year. Net earnings were $4,291,884 as compared with $4,202,881. The surplus and reserve of the previous year amounted to $8,888,790 last year and to $8,032,211 in the preceding year. Total surplus earnings therefore were $13,180,674 as compared with $12,235,092. Cash dividends on the preferred stock were $854,172 in each year. Cash dividends on the common stock were $1,374,497 last year as compared with $1,246,065 in the previous year, and these respective amounts were also paid during the years named as stock dividends on the common stock. The surplus at the close of the year was $9,577,508 for last year and $8,888,790 in the preceding year. The surplus at the close of the last year is divided between $5,500,939 reconstruction reserve and $4,076,569 undivided earnings.

Southern Indiana Power Company Control Sold.—Announcement has been made of the formal transfer of the Southern Indiana Power Company from its former owners, headed by Mr. Horace C. Stillwell, of Anderson, Ind., to a group of capitalists, headed by Mr. Chester P. Wilson, of Indianapolis, president of the Interstate Public Service Company. The Interstate Public Service Company is controlled by the Middle West Utilities Company, of which Mr. Samuel Insull is president. The Southern Indiana company supplies energy to stone quarries and mills of the Monroe and Lawrence County limestone district in Indiana. The company's new officials, it is said, are planning to construct another power dam at Shoals, Ind., in the White River, to supply power to French Lick, West Baden and other southern Indiana cities from a new station projected there. Already a power dam exists at Williams, Ind., from which the company supplies the stone districts with power. The capital stock of the Southern Indiana Power Company is $800,000. It was organized four years ago by Mr. H. C. Stillwell. The transmission lines of the company were extended to Monroe County last fall. A city franchise was granted by the city council of Bloomington at that time, and the offices of the company, formerly in Indianapolis, were moved to Bloomington. The newly elected officers of the company are: Chester P. Wilson, Indianapolis, president; Frank P. Smith, Whiteland, vice-president; Ira E. Guthrie, Indianapolis, secretary and treasurer; directors, the officers and Stanley E. Russell and Thomas A. Elger, Indianapolis. The Southern Equipment & Supply Company, of Bedford, also was purchased by the new owners of the power company. This company handles electrical and quarrying supplies.

Illinois Traction System Operations.—Earnings of the Illinois Traction Company for the calendar year 1913 amounted to $7,948,097 as compared with $7,415,647 in 1912, or a gain of 7.18 per cent. Of the total earnings $1,977,349 was received from the sale of electric energy. During the year there was expended on maintenance, renewals and betterments of all the properties $1,343,489, or 16.9 per cent of the gross revenue, as compared with 15.7 per cent in the previous year. In the annual report it is stated that the usual rate of increase in consumers prevailed on the city electric and gas properties and that exceptionally large industrial contracts were secured at Bloomington and Decatur.

Electrical Gains of United Gas Improvement Properties.—The annual report issued to stockholders of the United Gas Improvement Company shows that for the properties outside of Philadelphia the sales during 1913 compared with sales in 1912 as follows: Electric, 13.3 per cent increase; manufactured gas, 5.84 per cent increase; natural gas, 19.97 per cent decrease. In the city of Philadelphia the sales increased 2.84 per cent. The total earnings were $8,613,194, a decrease of $1,875 from 1912. Expenses were $1,142,087, an increase of $51,708 over 1912. Net profits were $7,471,107, a decrease of $53,583 from the previous year. Dividends of 8 per cent were paid on the stock. The treasurer's statement shows a decrease in net profits of leased works and receipts from investments in stocks and bonds of $1,032,342 as compared with 1912. This was mainly due to a great advance in the cost of gas oil and an increase in the payments to the city of Philadelphia out of receipts from gas sold to private consumers. This was offset by a profit of $1,060,806 from the sale of a part of the holdings of certain securities acquired thirteen years ago. From the sale of the rest of these securities the company has made an additional profit in 1914 of $2,172,812, which will appear in the next year's report.

Ontario Power Company Operations.—The annual statement of operations of the Ontario Power Company of Niagara Falls and the Ontario Transmission Company, Ltd., covering the year 1913, shows sales of power of $1,559,127 as compared with $1,233,669 in 1912. There were deducted in 1913 for purchased power $69,662 and for government rental $79,376, leaving gross earnings of $1,410,089. Corresponding deductions in 1912 were $3,674 and $66,471. The remaining gross earnings were $1,410,089 in 1913 and $1,163,524 in 1912. Operating expenses last year were $194,773 as compared with $171,434 in the previous year. Net earnings were $1,215,316 in 1913 and $992,090 in 1912. Other receipts amounted to $68,526 in 1913 and $22,286 in 1912. Total net income was $1,283,842 last year as compared with $1,014,376 in the preceding year. Interest aggregated $755,675 last year and $648,936 in 1912. The balance over fixed charges was $528,167 in 1913 and $365,440 in 1912. Dividends of 5 per cent were paid on the stock. The balance sheet surplus as of Sept. 31, 1913, was $515,482. J. J. Albright, the president, comments on the fact that the growth of the business during the year shows a very decided increase over the previous year. There were generated in 1913 639,081,290 kw-hr. as compared with 510,965,958 kw-hr. in 1912. Through the Hydroelectric Power Commission forty-five municipalities were served at the date of the report and five more were to be added shortly. When the 1912 report was issued the company had ten generators installed with a rated capacity of 117,000 hp. Since then the company has completed the installation of four additional units of 14,000 hp each.

General Electric Results in 1913.—The annual report made to stockholders of the General Electric Company covering the results of the year ended Dec. 31, 1913, shows that the percentage of profit on sales in 1913 was 9.6 per cent. This is a little better than the record of 1912, which showed 9.1 per cent. It is not so large, however, as the profit of 1911, which reached 11.3 per cent on the sales billed. This is one effect of the condition mentioned in the annual report arising from the tendency toward an increase in the number of orders received and a reduction in the average value thereof. It is interesting to compare the increase in the capitalized value of the manufacturing plant account with the record of business growth. The percentage of increase in manufacturing plants account over 1912 was 19.8, which is close to the rate of gain in amount of sales billed. The increase in the number of square feet of manufacturing floor space was 14.3 per cent. The statement of income account shows that the profits from sales were 26.7 per cent greater in 1913 than in 1912. As there was a decrease in other income, however, accompanied by an increase in the interest charges, the balance applicable to dividends on the stock showed an increase of but 3.8 per cent over 1912. The decrease in other income was equal to 24.1 per cent. This appears to have been due principally to the fact that the company did not report any profit on securities sold, whereas in the previous year this was one of the factors in the return. The same conservative policy with respect to the non-capitalization of patents which has been followed in other years again characterizes the report. Another feature of a similar character is the expenditure of $691,429 for shop equipment, vehicles, furniture and office appliances during the year, all of which was written off, so that the net book value of these items remains unchanged from the $1 at which they had previously been carried in the balance sheet.

New York Edison Company Report.—Extracts from the annual report of the New York Edison Company for 1913 have been made public by the New York Public Service Commission, First District. In the report as made public "contingency expense" and "subway rents" were reclassified in accordance with the accounting regulations of the commission. Operating revenues amounted to $23,011,195. Operating expenses as corrected were $9,200,244. Taxes were $1,286,508. Uncollectible bills amounted to $107,857. The total revenue deductions as corrected were $10,594,609. The operating income as corrected was $12,416,586. Non-operating revenue amounted to $1,289,974, from which there were non-operating revenue deductions of $39,413, leaving $1,250,561 non-operating income. This made the gross income applicable to corporate and leased properties, as corrected, $13,667,147. Total income deductions as corrected were $4,198,506, leaving a net corporate income as corrected of $9,468,641. Other credits to surplus amounted to $5,315. The previous surplus was $26,352,220, making a total surplus of $35,826,176. From this amount there were deducted $3,197,665 as renewal and contingency reserve, $3,009,204 as dividends of 6 per cent on the stock and $4,603 as miscellaneous debits, a total of $6,211,472. The surplus at the close of the year as reported was $29,614,704. Installations during the year amounted to $5,039,264, divided as follows: Additions, $3,958,284; betterments, $535,776; replacements, $526,655; other department additions, $18,549. Withdrawals or retirements amounted to $1,181,222, of which $1,139,113 represented capital installed prior to Dec. 31, 1908, and $42,109 subsequent changes. The net additions in 1913, therefore, were $3,858,042. The total gross fixed capital as of Jan. 1, 1913, was $123,012,223; the amount as of Dec. 31, 1913, was $126,870,265. Deducting the reserve of $15,820,315 for renewals and contingencies, the net fixed capital as of Dec. 31, 1913, was $111,049,950. The credit balance in the renewal and contingency reserve at the beginning of the year was $13,602,130. The amount credited to the reserve during the year was $3,197,666, making a total of $16,799,796. Charges to the reserve during the year amounted to $1,181,222, or, after allowance for material placed back in the storeroom and materials sold, $201,742, to $979,480. The credit balance at the close of the year was $15,820,316. The principal classes of operating expense were as follows: Production expenses, $3,355,176, or 0.621 cent per kw-hr. sold; transmission expenses, $404,165, or 0.075 cent per kw-hr.; total electric storage expenses, $30,558, or 0.006 cent per kw-hr.; total distribution expenses, $1,410,620, or 0.261 cent per kw-hr.; total utilization expenses, $995,480, or 0.184 cent per kw-hr.; total commercial expenses, $1,363,004, or 0.253 cent per kw-hr.; total general and miscellaneous expenses, corrected, $1,641,241, or 0.304 cent per kw-hr.; total operating expenses, corrected, $9,200,244, or 1.704 cents per kw-hr. There was supplied to other companies 67,040,299 kw-hr.; sold to the public, 472,988,478 kw-hr.; used, 14,172,603 kw-hr.; unaccounted for (indicated not actual), 128,204,849 kw-hr. The number of consumers was 136,180 and the number of active meters 193,656. The average sales per meter were 207 kw-hr. The maximum load was 211,563 kw, carried for fifteen minutes on Nov. 5, 1913.

Central-Station Returns for the Atlantic States for March.—Central-station returns for the month of March received from companies operating in the Middle Atlantic States indicate a slower rate of increase, both on gross earnings and energy output, than has come to be regarded as usual. These states include New York, New Jersey and Pennsylvania, which between them are responsible for one-quarter of all the energy generated in the country. The companies operating in the cities of New York and Philadelphia, together with the great New Jersey system, were alone responsible for an output of over 143,000,000 kw-hr. in the month of March, and it is known that the output of the entire country was less than nine times that amount. Returns received by the *Electrical World* from properties in these three states, which, on the basis of output, combine to form some 67 per cent of the industry of the Middle Atlantic group, show gross earnings for March, 1914, of $5,603,720 as compared with $5,282,154 for March, 1913—an increase of 6.1 per cent. For the same period the kilowatt-hours of energy output increased, at a rate of 7.5 per cent, from 196,343,544 to 210,843,247. Taking these rates of increase as thoroughly typical for this section of the country, it is possible to estimate quite closely that for all the central stations in the Middle Atlantic group the gross earnings increased from $9,717,000 in March, 1913, to $10,300,000 in March, 1914, while the energy output in the same period increased from 292,500,000 kw-hr. to 314,500,000 kw-hr. From this it is not difficult to realize something of the demand which the growth of the industry in this area is making upon the banks. With the light and power utilities of the Middle Atlantic States acquiring business which represents some $600,000 of increased earnings in the month, it may be estimated quite conservatively that they have to find, and invest in their properties, some $3,000,000 or $4,000,000 of new capital every month. A considerably higher rate of increase is indicated by the central stations falling within the South Atlantic group, which comprises Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia and Florida. It may be remembered that it was within this group of states that the most spectacular figures of electrical expansion, as disclosed by the 1912 census, were to be found. Between 1907 and 1912 the output of all the central stations of the South Atlantic States increased from 266,437,115 kw-hr. to 749,856,425 kw-hr., or at an annual average rate of 36.4 per cent, while the income grew from $7,672,229 to $15,940,380, at an annual average rate of 21.6 per cent. March returns show some falling off from these phenomenal figures, but indicate that wonderful increases are still being obtained.. The *Electrical World* has received data from the companies in practically every one of the principal cities in this group, the combined output of which is a little less than 50 per cent of all the energy generated in the South Atlantic States. For these companies gross earnings increased from $993,248 in March, 1913, to $1,104,010 in March, 1914, or at a rate of 11.3 per cent, while the energy output of stations increased from 41,940,503 kw-hr. in March, 1913, to 51,452,013 kw-hr. in March, 1914, or at a rate of 22.8 per cent. It should be noted that these very striking figures involve no guesswork, but are founded upon authentic data. For the whole of the South Atlantic group it may therefore be safely computed that the March gross earnings of all the central stations was $1,798,000 against $1,615,000 for March, 1913, and the energy output 104,500,000 kw-hr. against 85,170,000 kw-hr. Than this no finer object-lesson can be found as to the stability of the electric industry in times of business depression. The period from 1907 to 1912 was a period of great industrial activity the country over. For the last twelve months the pace has materially slackened, until the spring of 1914 sees many of the greatest revenue-producing industries in a worse position than they have been for many years. In spite of this the electrical utilities in the states along the South Atlantic seaboard are still piling on new business at a rate of over 20 per cent per annum. It should be stated that all reference to gross earnings in the foregoing is intended to cover gross revenue from the sale of electricity only. The figures relate strictly to central-station companies, and though revenue from the sale of energy for railway loads is of course included, no inclusion is made of receipts from street-car fares, etc., of any of these companies.

Business Notes

The Koerting & Mathiesen Company moved its office on May 1 to 49-53 East Twenty-first Street, New York.

The Pittsburgh High-Voltage Insulator Company has moved its Los Angeles office to 757 South Los Angeles Street.

The Hollings Company, dealer in electric-lighting fixtures, has recently changed its corporation from Maine to Massachusetts.

The Pure Water Apparatus Company has moved its main office from Philadelphia, Pa., to the new Adams Express Building, at 61 Broadway, New York City.

Norton and Bird, consulting engineers on public service properties, have moved their Chicago headquarters to 111 West Monroe Street, in the Harris Trust Building.

The Copeman Electric Stove Company, Flint, Mich., has developed a complete new line of electric ranges and accessories and, having obtained considerable new capital, is planning to market these energy-consuming devices with renewed activity.

The High-Tension Electric Company has been organized, with headquarters at 321-325 Susquehanna Street, Indianapolis, Ind., to carry on a business of manufacturing and repairing high-tension coils and magnetos. A. H. Wagner, manager of the company, has spent ten years in the auto ignition business, and A. F. Robertson, its treasurer, has been in the automobile business since its infancy.

The Electrical Engineers' Equipment Company, formerly at 10 North Desplaines Street, Chicago, moved into a new and larger building at 711-715 West Meridian Street, that city, on May 1. With the purchase of this new brick building the company now owns and occupies a three-story factory, with basement, which contains approximately 29,000 ft. of floor area. The products of the company are power-house appliances and specialties. N. Woodmansee and W. McKerrow are respectively president and secretary of the company.

New Industrial Companies

The Detroit Electric Welding Company, Detroit, Mich., has been incorporated for $10,000. Among the principal stockholders are Harry M. Lau, B. M. Greenfield and George M. Sayles.

The Price Electric & Manufacturing Company, of Basic City, Va., has been incorporated with a capital stock of $500,000. The officers are Paul Steinman, of Waynesboro, Va., president, and T. A. Sammis, of Basic City, secretary.

The Henderson-Lee Company, of Chicago, Ill., has been incorporated with a capital stock of $500 by R. F. Henderson, Ray P. Lee and George J. Tramer. The company purposes to sell, buy and deal in electrical and mechanical industries.

Nathan Klein & Company, of New York, N. Y., have been incorporated by Nathan Klein, 208 Center Street, New York; David Price and Isadore Jacoby, of New York. The company is capitalized at $20,000 and proposes to deal in electric motors.

The Lucas Signal & Control Company, of Chicago, Ill., has been incorporated with a capital stock of $10,000 to manufacture and deal in electrical appliances, etc. The incorporators are Paul Pierce, Everett N. Murphy and Joseph N. Pierce.

The Piedmont-Electro Chemical Company, of Charlotte, N. C., has been incorporated by I. Bechenleikner, D. C. Carmichael and E. R. Bucher, all of Charlotte, N. C. The company is capitalized at $100,000, and proposes to manufacture and deal in electrochemical machinery, dyestuffs, etc.

The Johnson Electric Smelting Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,500,000 for the purpose of manufacturing electric furnaces, machinery, etc. The incorporators are H. R. Martindale, W. F. Cook and W. I. N. Lofland, all of Dover.

Trade Publications

Motors.—Bulletin 29 of Fairbanks, Morse & Company, Chicago, Ill., gives a comprehensive description of its "TRC" motors and generators for direct current.

Metal Molding and Fittings.—The National Metal Molding Company, Pittsburgh, Pa., has issued an attractive booklet of ninety-six pages, profusely and interestingly illustrated, which is entitled "A Handbook on National Metal Molding and Fittings." This handbook lists each fitting and describes its assembly and installation.

Meter Tester.—In Circular No. 19 the States Company, 19 New Park Avenue, Hartford, Conn., illustrates a resistor device for use as artificial loads in meter testing. The device is essentially a combination of a constant-potential transformer with low-voltage secondary, resistors connected in the secondary and switches for varying the load.

Condenser.—The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., has issued a unique display card. It contains two small samples of its condensers, the one showing the material used in the making of the condenser and the other showing this material subjected to a pressure of 2.5 tons per sq. in. after being impregnated with pure paraffine.

Sewage Disposal Apparatus.—The Sanitation Corporation, 50 Church Street, New York, specialist in apparatus, equipment and complete plants for sewage disposal, has issued a bulletin, Series G, No. 1, which sets forth the facilities of the company for installing complete sewage-disposal plants. Some illustrations of apparatus used for sewage disposal are given, as well as a partial list of foreign installations.

Industrial Trucks.—Bulletin No. 109 published by the Elwell-Parker Electric Company, Cleveland, Ohio, tells in an interesting manner of the development of electrically operated railroad and industrial trucks for handling baggage, freight and other material. A general description of the Elwell-Parker truck is given, as are also some performance data. The numerous pictures make an effective and convincing argument as to the advantages of this modern way of handling material in bulk.

Engines.—Bulletin No. 111-B of the Buckeye Engine Company, Salem, Ohio, gives a complete description of the Buckeye-mobile. This is a self-contained power plant for effective utilization of high-pressure superheated steam. It is claimed that it will develop a brake horse-power on less than 1½ lb. of coal per hour. Many illustrations are given, with tables and drawings showing capacity and general dimensions. An interesting table gives the comparative heat losses and coal consumption of typical power plants.

Lighting Practice in Various Industries.—Three interesting, instructive bulletins, giving the latest information on incandescent lamps and lighting, have recently been published by the Edison Lamp Works of the General Electric Company, Harrison, N. J. The titles are "The Lighting of Wood-Working Plants by Modern Methods," "The Lighting of Machine Shops and Metal Working Plants," and "Modern Lighting Practice in the Clothing Industry." The bulletins are well printed, generously illustrated and are inclosed within neat covers.

A New Edison Publication.—The *Edison Business Builder*, Vol. I, No. 1, is replete with up-to-date selling suggestions of value to the entire electrical industry. The publication has been issued by the Edison Lamp Works of the General Electric Company, Harrison, N. J. It represents a real spirit of helpfulness on the part of the manufacturer toward the dealer and cannot fail in its mission of education of the general public as well as of the dealer. The publication is well printed and contains some excellent illustrations, as well as useful lighting data.

Co-operation with the Dealer.—The New York Gas Appliance Company, 569 Broadway, New York, has its imprint as publisher on *Co-operation*, a publication that is to be issued monthly "in the interest of the gas and electric industries." Vol. I, No. 1, contains some good illustrations of a well-selected line of gas and electric fixtures. The large size of the publication shows the various fixture combinations effectively and will be found of assistance to the dealer and the prospective purchaser in making selections. The editorial page contains some practical hints to dealers.

Purifying Transformer Oil.—The Elliott Company, 6910 Susquehanna Street, Pittsburgh, Pa., has issued Bulletin No. 87, describing its capillary filter and telling of the results accomplished with this apparatus in restoring used transformer and switch oils to their original value. An illustration is given of the filter, showing its method of operation. The filters are made in sizes from 10 gal. per day up to 50 gal. and are supplied with electric heating coils for 110-volt alternating current or direct current. The central-station manager will be interested in this useful accessory to his plant.

Heating Appliances.—The twenty-four page catalog of the Despatch Manufacturing Company, Minneapolis, Minn., gives practical evidence of the advance made in the design and manufacture of heating appliances, and more especially of electric ovens. In this catalog are shown ovens for testing in flour-mill laboratories, for bakeries, for drying, for moisture tests of soils, for baking enamel, japan and lacquer, for household use and for other purposes. Electric air heaters and hot-water heaters are also illustrated and briefly described. The electric ovens are used in a wide variety of industries. The catalog is well printed and illustrated.

Indicator for Lamps.—An ingenious device has been brought out by the Edison Lamp Works of the General Electric Company, Harrison, N. J. It consists of two celluloid disks, 3⅞ in. in diameter, which are calibrated to indicate at once the operating characteristics of lamps made by this company. The red marks traveling along the slotted curves give approximate figures for any change in voltage, while exact figures for changes of 1 per cent appear in the rectangular openings. The "cost of lighting" curve gives the relative cost of producing the same quantity of light at different voltages. It is based on a rate of 10 cents per kw-hr. with the 60-watt lamp at list price.

Rubber Insulation Report.—The report of the joint rubber insulation committee, recommending a well-defined method of procedure in the analysis of rubber for insulation and other uses, has just been reprinted by the Simplex Wire & Cable Company, Boston, Mass. The full report of this committee provides a method of avoiding misunderstandings in working with rubber analyses and consists of twenty-four pages. This report was prepared by a number of interests identified with this subject, including the United States Signal Service and Bureau of Standards, the American Chemical Society, two of the large trunk-line railroads, and four of the manufacturers of rubber-insulated wires, of which the Simplex company was one.

Portfolio of Lighting Data.—The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, Ill., has brought out a portfolio, in which are incorporated a fifty-two-page brochure relating to interior lighting planning and specifications and an envelope that contains twenty-four detail drawings giving complete illumination and installation data covering a wide range of installations. While intended primarily for architects, this elaborate work will be found of great interest to illuminating engineers. Practically all phases of modern illumination, both interior and exterior, have been considered, and the work has been well done. The envelope has been made large enough to admit of future additions. Each plate is indexed. The price of the publication is $5.

Booklet on Shop Lighting.—The Industrial Commission of Wisconsin has issued an instructive booklet on shop lighting, prepared by Mr. Fred Schwarze, electrical engineer of the Pfister & Vogel Leather Company, in whose plant many of the results outlined were obtained. The contents suggest the comprehensive manner in which the subject has been treated: "Good Light Saves Money," "Types of Lamps," "Reflectors," "Amount of Light for Various Departments and Conditions," "Suggestions for Installation," "Standards Recommended for Various Departments and Conditions," "Natural Light," "Orders of Industrial Commission on Shop Lighting." The reading matter is well prepared and fully illustrated. The publication is worthy of its sub-title, "A Handbook for Superintendents and Electricians."

Personal Mention

Mr. Alba H. Warner has been appointed manager of the Galveston (Tex.) Electric Company, succeeding Mr. L. C. Bradley.

Mr. R. W. Morrison has been appointed manager of the Laredo (Tex.) Electric & Railway Company, succeeding Mr. Frank E. Scovill, who recently resigned.

Mr. Frank E. Scovill has resigned as manager of the Laredo (Tex.) Electric & Railway Company and has entered the business of onion farming near Laredo.

Mr. C. H. Nandell has been appointed manager of the Marshall (Tex.) Electric Company, succeeding Mr. E. L. Wells, Jr., who recently resigned owing to ill health.

Mr. H. C. Sterling, of Three Rivers, Mich., president of the Michigan Section of the National Electric Light Association, has been appointed statesman of the Jovian Order for Michigan.

Mr. William C. Comer, assistant division superintendent of the Metropolitan Street Railway Company, of Kansas City, has resigned to enter the electrical contracting business independently.

Mr. Arthur Cushing has been appointed operating engineer of the Clinton (Ill.) Gas & Electric Company. He was formerly with the Decatur Railway & Light Company and other Illinois Traction properties.

Mr. David Daly, general manager of the Houston (Tex.) Electric Company and the Houston-Galveston interurban electric railway, is recovering from an unusually severe and protracted attack of typhoid fever.

Mr. F. J. Blaschke, of Cleveland, representing the engineering department of the National Lamp Works of the General Electric Company, gave an informal talk on May 11 before the Chicago Jovian League on "The Proper Lamp for the Circuit."

Mr. A. H. R. Jackson, formerly general superintendent of the properties of the Illinois Traction System in Jefferson City, Mo., has been made general superintendent of the Oskaloosa Light & Traction Company, Oskaloosa, Ia., which is also an Illinois Traction property.

Mr. H. M. Wall, who for the past year has been connected with the Memphis Street Railway Company as assistant chief engineer of power stations, has become associated with the firm of Ruebel & Wells, consulting mechanical-electrical engineers, Chemical Building, St. Louis, Mo.

Mr. Foster Hannaford has been appointed acting general superintendent of the Galesburg (Ill.) Railway, Lighting & Power Company, vice Mr. Dickerson McAfee, now on a leave of absence. Mr. Hannaford has been operating engineer of the company, which is one of the subsidiaries of the Illinois Traction System.

Mr. Emil Gruenfeldt, chief engineer for the Baker Motor Vehicle Company, of Cleveland, sailed last week for Europe. Mr. Gruenfeldt will be abroad about two months, during which time he expects to take a brief vacation in Germany, and also to make an investigation of recent foreign motor-car developments.

Mr. Harry Chapin Plummer has been engaged by the Society for Electrical Development as assistant in the news and advertising department. Mr. Plummer has had several years' training in active newspaper work, is a writer on engineering and technical subjects and has made a specialty of presenting in popular form subjects of an academic character.

Mr. D. W. Snyder, formerly superintendent of the Clinton (Ill.) Gas & Electric Company, has been appointed general superintendent of the Jefferson City, Bridge & Transit Company and the Jefferson City Light, Heat & Power Company, all of which properties are subsidiaries of the Illinois Traction System. Mr. Snyder has been succeeded at Clinton, Ill., by Mr. Charles Cline.

Mr. Arthur Casson Hobble, until recently electrical construction engineer for the Mexican Northern Power Company at Santa Rosalia, Chihuahua, Mexico, is spending some time in Chicago, having formed a connection with the Chicago Association of Commerce committee of investigation on smoke abatement and electrification of railway terminals. Mr. Hobble is a graduate of the University of Illinois and a member of the American Institute of Electrical Engineers.

Mr. Williston Fish, vice-president of the Chicago Surface Lines, has accepted appointment as vice-president of the West Penn Traction Company, of Pittsburgh, which operates electric-service as well as railway properties. Mr. Fish is a West Point graduate and former United States army officer. He was later admitted to the bar in Chicago, in which city he has resided since 1887. For twenty-four years Mr. Fish has been connected with the surface-railway companies of Chicago, nearly all of that time in executive positions. He took a prominent part in the negotiations leading to the traction-settlement ordinances of 1907. No man in public-utility circles in Chicago has made a better reputation for fair-mindedness. Mr. Fish is also the possessor of exceptional literary gifts, and some of his compositions, both prose and verse, have had a wide circulation.

Mr. H. C. Spaulding, who has just joined the staff of the Society for Electrical Development, Inc., as manager of the news department, is a graduate of the Massachusetts Institute of Technology. He was for some years identified with the Thomson-Houston interests, giving special attention to the development of motor applications. After organizing and for a time acting as manager of the electrical department of the Blake & Knowles Pump Company in New York he returned to Boston as New England manager of the Siemens & Halske Electrical Company, later occupying the same position for the American Stoker Company. For the last few years his headquarters have been in New York as assistant sales manager of the Triumph Electric Company and until recently district manager of the hoist department of the Yale & Towne Manufacturing Company. Mr. Spaulding is a member of various engineering organizations and a Jovian.

H. C. SPAULDING

Mr. A. H. Jones, the newly elected president of the Mississippi Electric Association, which is a section of the National Electric Light Association, is general manager of the McComb City Electric Light & Power Company, McComb, Miss. He was formerly vice-president of the state association and for several years has been active in its affairs as secretary-treasurer. Mr. Jones was born at Boston, Mass., in 1881, and after the usual preliminary training entered the course in marine and electrical engineering of the Massachusetts Nautical School, Boston, from which he was graduated in 1899. He next took up the testing course offered by the General Electric Company at its Schenectady and Lynn shops, and in 1902 was transferred to that company's sales organization with headquarters at Atlanta, Ga., and later New Orleans, La. In 1904 Mr. Jones was appointed superintendent of the McComb company's system, but he has served as general manager since 1906.

Obituary

Dr. Paul L. T. Héroult, well known for his pioneer work in the electrometallurgy of aluminum and steel, died in Paris, France, on May 9. He was fifty-one years old, having been born on April 10, 1863, at Thury-Harcourt, Calvados, Normandy. His aluminum process, which he discovered simultaneously with and independently of Mr. Charles M. Hall, is in successful use in Switzerland, France, Canada and the United States, while his electric-steel-furnace patents have been taken over by the United States Steel Corporation.

Construction

New England

BANGOR, MAINE.—The Bangor Ry. & El. Co. contemplates extensions and improvements to its lighting, power and street railway systems, involving an expenditure of $191,000, of which $43,000 will be used for reconstruction work in Bangor, $28,500 for new waterwheels and generators at the Veazie power station, and $37,000 in extending the lines of the Bar Harbor & Union River Pwr. Co., a subsidiary company in Hancock County. The transmission lines are being extended from Ellsworth to Bluehill, a distance of 20 miles.

MILO, MAINE.—The town of Milo has awarded the contract for street-lighting to the Milo Elec. Lt. & Pwr. Co., for a period of 10 years. The contract calls for seventy 75-watt lamps, to take the place of the 60 lamps of 25 cp now in use. The company also agrees to light the new bridge without additional cost, the ornamental fixtures to be furnished by the town.

EAST BRAINTREE, MASS.—The electric light commissioners expect to purchase within the next six months some electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, etc. Fred B. Lawrence is manager.

FARLEY, MASS.—The Franklin County Pwr. Co., which recently purchased the property of the Farley Paper Co., at Farley, is reported to be making preparations to utilize the water-power at the dam to generate electricity. A high-tension transmission line will be erected from this new generating station to the main plant of the Athol Gas & El. Co., at Wendall. The latter company will probably erect the transmission line for the Franklin company, which will sell the energy generated at the plant to the Athol company.

LUDLOW, MASS.—The Ludlow Mfg. Associates has been granted pole locations for a transmission line from the Holyoke road west to Chicopee.

SPRINGFIELD, MASS.—The City Council has awarded the contract for street-lighting to the United El. Lt. Co. for a period of ten years. The new contract provides for relocating about 400 arc lamps and for about 250 additional new lamps.

HARTFORD, CONN.—Bids will be received by the Board of Contract and Supply, City Hall, Hartford, until May 26, for lighting fixtures for the Hartford municipal building. Drawings and specifications, etc., may be obtained at the office of Davis & Brooks, architects, 49 Pearl Street, Hartford. Joseph Butts is secretary.

MERIDEN, CONN.—The City Council has appointed a committee to make investigations with a view of installing an ornamental street-lighting system in the business section of the city.

SOUTH NORWALK, CONN.—The South Norwalk Electric Works are considering the installation of underground conduits and ornamental street lamps and standards. Albert E. Winchester is general superintendent of the South Norwalk Electric Works.

Middle Atlantic

ARGYLE, N. Y.—The engineers engaged to make an examination of the water-power available to operate an electric-light plant for the Washington County Almshouse at Argyle report that sufficient power is available without injuring the water supply. The cost of installing the plant is estimated at $3,500.

HORNELL, N. Y.—The Hornell El. Co. contemplates improvements to its plant, to cost about $80,000. The proposed work will include the erection of a power house, 50 ft. by 60 ft., to be addition to the present Hill Street plant; the installation of two 1000-hp turbo-generator sets, contracts for which have been awarded. A large electrical crane and several smaller machines will be installed. The company will also extend its transmission lines to North Hornell and make several changes throughout the city.

JAMAICA, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner Park Avenue and Fifty-ninth Street, New York, until May 18, for installing electric equipment in the addition to and alterations in Public School 45, on Maple Street, Jamaica. Blank forms, plans and specifications may be obtained or seen at the above office, and at the branch office, 69 Broadway, Flushing, borough of Queens.

JAMESTOWN, N. Y.—The Board of Water and Lighting Commissioners has awarded the contract for a 1000-kw turbo-generator for the municipal electric-light plant to the General El. Co., at $19,587.

LUZERNE, N. Y.—The Riddell El. Lt. Co. is installing an electric-lighting system in Luzerne. The distributing system will require 4 miles of wire (No. 4 and No. 6) erected on 35-ft. chestnut poles. Nitrogen incandescent lamps will be used for street lighting. The company is doing its own construction work. E. E. Riddell is president of the company.

MONGAUP, N. Y.—The Mongaup Lt., Ht. & Pwr. Co. has applied to the Public Service Commission for permission to construct a plant and to exercise franchises in Sullivan County.

NEW HARTFORD, N. Y.—Bids will be received by Clarence B. Brooks, clerk of the board of education of the Union Free School District No. 8, Chadwicks, N. Y., until May 25 for construction of school house, including electric wiring and fixtures, heating and ventilating apparatus and water system, etc. Plans and specifications are on file in the office of Walter G. Frank, architect, Clarendon Building, Utica, where copies may be obtained upon application.

NEW YORK, N. Y.—The New York Edison Co. has been granted permission by the Public Service Commission to issue $15,800,000 in additional capital stock.

NIAGARA FALLS, N. Y.—Bids will be received by the Board of Public Works until May 19 for lighting the streets of the city on three-year and five-year contracts. The contract with the Buffalo & Niagara Falls El. Lt. & Pwr. Co. expired last December.

OGDENSBURG, N. Y.—The Ogdensburg Pwr. & Lt. Co. has submitted a proposal to the officials of Maple City offering to install an ornamental lighting system on Ford Street, provided the city will enter into a new contract with the company for a period of five years, at $11,000 per annum. The company will erect 38 standards on Ford Street, 18 of which will carry five-lamp clusters, while the other 20 will carry four lamps each and, instead of carrying a fifth lamp, will support the trolley wires. The cost will be about $7,000. All wires will be placed underground.

CLAYSVILLE, PA.—The West Penn Ltg. Co. has applied to the Borough Council for a franchise to furnish electricity in Claysville. The company proposes to furnish the service from its power plant near Point Marion on the Cheat River.

ERIE, PA.—Plans for the conduit system in State Street have been approved by the power companies. An appropriation of $42,000 has been made for the system. Work will begin about June 1.

HANOVER, PA.—The capital stock of the Hanover Lt., Ht. & Pwr. Co. has been increased from $60,000 to $100,000.

HERSHEY, PA.—We are informed that the damage to the power plant of the Hershey Chocolate Co. was not so bad as reported in the issue of May 9. The generators have all been repaired and new buildings are being erected. The company is building a new power house which will have an output of 4000 hp, equipment for which has already been purchased. Ezra B. Hershey is treasurer.

PITTSBURGH, PA.—The contract for the construction of a large brick and steel addition to the power plant of the Duquesne Pwr. Co., of Pittsburgh, on Brunot's Island, has been awarded to D. T. Riffle.

PITTSBURGH, PA.—Extensive additions and improvements are contemplated by the West Penn Trac. Co. in the next two years, which will involve an expenditure of $4,000,000, of which about $84,000 will be used for the Pennsylvania electric lines, $80,000 for the Wheeling Trac. Co., of Wheeling, W. Va., $1,400,000 on generating stations, $500,000 on transmission lines, $230,000 on substations, and $650,000 on distributing systems.

POTTSVILLE, PA.—J. I. Reed, proprietor of the Union Knitting Mills, of Pottsville, it is reported, contemplates the installation of an electric power plant to operate the mills.

TARENTUM, PA.—The Borough Council has granted the Allegheny Valley Tel. Co. a franchise to install a telephone system in Tarentum. The company, which is to be capitalized at between $75,000 and $100,000, has also been granted franchises in the borough of Brackenridge and Harrison Township.

WILLIAMSPORT, PA.—Bids will be received by Samuel Stabler, superintendent of public affairs, Williamsport, until June 10 for lighting the streets, parks and public places with electricity for a period of three, five and ten years from Dec. 1, 1914; also bids for lighting the city hall and the several fire-engine houses for a similar period. The specifications provide for a minimum of 221 arc lamps.

RAHWAY, N. J.—The special committee appointed by the Council to investigate the feasibility of establishing a municipal electric-light plant has submitted its report, in which it states that a generating plant could be installed for about $25,000 and a distributing system for from $25,000 to $30,000 more.

CUMBERLAND, MD.—Leo T. Lawler has been appointed to make an investigation of the municipal electric plant and submit report with a view of making extension and improvements to same. J. S. Schriever is commissioner of water and lights.

FRIENDSVILLE, MD.—Plans are being considered by the Youghiogheny Pwr. Co. for the development of the water-power of Youghiogheny River and tributaries in Garrett County and construction of power plant near Friendsville. Three dams will probably be built, forming a reservoir 6 miles long, to develop about 40,000 hp. Electricity generated at the plant will be transmitted throughout western Maryland and to cities in western Pennsylvania. Parties interested in the company have also organized the Youghiogheny Wtr. & El. Pwr. Co., which is planning a hydroelectric development at Swallowsville, Md. John Bogart, 141 Broadway, New York, N. Y., is engineer, and Charles L. Pullen, of New York, N. Y., is vice-president.

WILLIAMSPORT, MD.—The proposal to issue $40,000 in bonds for the installation of a municipal electric-light plant and water-works system will be submitted to the voters on June 8.

WHITE SULPHUR SPRINGS, W. VA.—Plans are under consideration by the Mountain Milling Co. for remodeling its electric-light plant. It is understood that new equipment will be installed.

RICHMOND, VA.—The Old Dominion Iron & Nail Works are contemplating the construction of a reinforced-concrete and steel power house on Belle Isle, to cost about $50,000.

WINCHESTER, VA.—The Northern Virginia Pwr. Co., of Winchester, it is reported, is installing a 1050-kw generating unit, consisting of a generator and waterwheel, at its power house in Millville, W. Va. P. O. Keilholtz, Continental Building, Baltimore, Md., consulting engineer, has charge of the work.

WASHINGTON, D. C.—Bids will be received at the Engineer Depot, United States Army, Washington Barracks, D. C., until May 20, for furnishing 125-volt direct-current switchboards. For further information address, Lt. Col. Thomas E. Kuhn.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 2 for furnishing supplies at the various navy yards and naval stations as follows: Brooklyn, N. Y., Schedule 6778—6000 ft. of armoring and leading interior communication cable; Schedule 6772—270 seamless brass intercooler tubes. Norfolk, Va., Schedule 6775—5400 lb. hard-rolled sheet copper, lined on one side, 48 in. by 96 in., weighing 56 oz. per square ft. Annapolis, Md., Schedule 6773—one Curtis turbine, nozzles and wheels with blading model, one valve mechanism and governor, steam chest, full size. Boston, Mass., Schedule 6777 — telephones, switchboard and spare parts. Bids will also be received until June 16 as follows: Mare Island, Cal., Schedule 6781—three two-motor electric traveling cranes; Schedule 6783—one 16-in. by 5-ft. motor-driven quick-change gear, geared-head lathe. Puget Sound, Wash., Schedule 6782—two cranes, 15 and 40 tons, with 5-ton auxiliary hoists. Semi-annual supply of gum and rubber gasket to be delivered at all yards as per Schedule 6785. Applications for proposals should designate the schedule desired by number.

North Central

ALMA, MICH.—The Alma Illg. Engineering Co., which was recently granted a franchise through the townships of Sumner and Seville, will erect a power plant in Riverdale. Equipment not yet decided upon. About 20 miles of wire will be required for transmission and distribution system: 35-ft. and 40-ft. poles will be used. H. S. Conner is engineer in charge.

BAY CITY, MICH.—The Bay City Electric Light Department has recently purchased three 50-lamp (4-amp. Westinghouse metallic flame-arc) outfits and will also purchase 100 arc lamps, to be installed this summer, making a total of 600 lamps for street-lighting system. William H. Fitzhugh is superintendent.

BAY VIEW, MICH.—The Bay View Camp Ground Association expects to purchase within the next four months about 50 meters, 20,000 ft. of wire with necessary pins, insulators, etc., and about 500 incan-

descent lamps from 20 to 60 watts. The plant is operated only during June, July and August. Electricity for operating the system is purchased from the Petoskey municipal plant. Luther C. Mason is superintendent of grounds.

BELDING, MICH.—The Citizens' Lt. Co., of Belding, is expecting to purchase about one carload of poles (30 ft. to 35 ft.). M. A. Reed is secretary.

CRYSTAL FALLS, MICH.—The electric light commission expects to purchase within the next four months one waterwheel (vertical type) and one 200-kw, three-phase, 60-cycle, 2300-volt generator. J. H. Sanders is superintendent.

DETROIT, MICH.—Preparations are being made by the Detroit United Ry. Co. for extensive improvements to its system both within and outside of the city limits of Detroit.

GREENVILLE, MICH.—The R. J. Tower El. Co., of Greenville, is rebuilding its dam and power plant and installing an additional turbine. All machinery and equipment has been purchased. S. L. Tower is manager.

ISHPEMING, MICH.—The City Council has decided to accept the proposal of the Marquette Gas & El. Co. for a new street-lighting contract.

LUDINGTON, MICH.—The Stearns Lt. & Pwr. Co., of Ludington, is planning to extend its transmission lines to New Era to furnish electrical service there.

LUDINGTON, MICH.—The contract for electric wiring and motors for the new factory of the Gile Boat Co., of Ludington, has been awarded to the Stearns Ltg. & Pwr. Co., of this place. The building will be one story high, 30 ft. by 160 ft. for the foundry and 50 ft. by 100 ft. for the testing room. W. L. Gile is general manager of the boat company.

MANISTIQUE, MICH.—Bids will be received by the school building committee of the St. Francis de Sales Congregation, addressed to Rev. B. J. Schevers, Manistique, Mich., until May 25 for construction of school building, according to plans and specifications prepared by Foeller & Schober, architects, Green Bay, Wis. Separate bids will be received on each of the following branches of the work: Mason work; cut-stone work; terra cotta; structural steel and iron work; carpenter work, including plastering and glazing; hardware and roofing; painting; plumbing; heating and ventilating; electric wiring. Bidders may submit proposals on two or more parts.

MENOMINEE, MICH.—The Menominee & Marinette Lt. & Trac. Co. has increased its capital stock from $1,000,000 to $1,250,000.

NORTH BRANCH, MICH.—The Council has practically closed a deal with the Schlegel Lt. & Pwr. Co., of Lapeer, whereby the latter will furnish electrical service here and light the streets of the village. The company asks for a five-year contract and will furnish a 24-hour service.

SAULT STE. MARIE, MICH.—The International Joint Commission has granted the joint request of the Michigan Northern Pwr. Co., of Sault Ste. Marie, Mich., and the Algoma Steel Co., of Sault Ste. Marie, Ont., for the erection of compensation works in the St. Mary's River midway between the two cities, subject to conditions which have been agreed upon by engineers of the two governments and the two corporations.

CANTON, OHIO.—The City Council is considering the question of compelling the electric, street railway and telephone companies to place their wires underground in the business section of the city.

CHARDON, OHIO.—Application has been made to the Ohio Public Utilities Commission by John B. Chapman, of Cleveland, for authority to issue $300,000 in capital stock and $425,000 in bonds, the proceeds to be used for the construction of an electric interurban railway between Chardon and Jefferson, 15 miles long.

CINCINNATI, OHIO.—The installation of electrically operated equipment at the central sewage pumping plant and the Main Street station is reported to be under consideration by Jerry O'Shaughnessy, superintendent of water-works.

CINCINNATI, OHIO.—The Union Gas & El. Co., of Cincinnati, is making investigations in Delhi, Sayler Park and Fernbank, which are suburbs of Cincinnati, with a view of extending its service to those towns. The company estimates that it will cost about $10,000 to extend its lines to the towns mentioned, but will do so if sufficient patronage is guaranteed. The Cincinnati, Lawrenceburg & Aurora Trac. Co., of Cincinnati, has also offered to furnish electricity in the above towns at city rates.

CLEVELAND, OHIO.—Bids will be received by A. R. Callow, commissioner of purchases and supplies, until May 28 for electric-light poles. Specifications are on file in the office of the commissioner of light and heat division, 1443 East Third Street, Cleveland.

CLEVELAND, OHIO. — Improvements and extensions will be made to the system of the Cleveland Tel. Co., involving an expenditure of $1,700,000, provided the State Public Utilities Commission authorizes an issue of $4,000,000 in notes, for which the company has made application.

COLUMBUS, OHIO.—Bids will be received by B. L. Bargar, director of public safety, City Hall, Columbus, until May 22 for 4996 ft. 20 twisted pairs of No. 16 B. & S. G. copper wire, in accordance with specifications copies of which are on file in the office of the director of public safety. All wire to be high-grade rubber-insulated lead-covered telephone cable.

JAMESTOWN, OHIO.—The Dayton Pwr. & Lt. Co., it is reported, will purchase the plant and holdings of the Jamestown El. Ltg. Co. Energy for operating the local system will be furnished from the central station at Dayton.

NELSONVILLE, OHIO.—The Hocking Pwr. Co., of Nelsonville, has applied for a 25-year franchise in Athens. The company, it is reported, contemplates the construction of a large central power station in Floodwood.

OAK HARBOR, OHIO.—Within the next three months the village of Oak Harbor expects to erect a substation, transmission lines, etc., to distribute electricity in Oak Harbor, to be supplied by the Northwestern Ohio Ry. & Pwr. Co. Contracts amounting to $13,991 for construction work and equipment have been awarded. The village recently purchased the property of the Oak Harbor El. Co.

PAINESVILLE, OHIO.—Plans and specifications have been prepared by the committee for the installation of an ornamental street-lighting system, to cost about $4,000.

PORTSMOUTH, OHIO. — The Portsmouth Tel. Co. is planning to extend its cables to New Boston, a distance of 5000 ft., and to lay a large quantity of underground conduit in Portsmouth.

SEBRING, OHIO.—The installation of an ornamental street-lighting system in the business section of the city is under consideration by the Board of Trade.

URBANA, OHIO.—The installation of cluster lamps in the business district of the city is under consideration by the City Council. About 40 standards will be required.

YOUNGSTOWN, OHIO. — Initial steps have been taken by the City Council for the establishment of a municipal electric-light plant by appropriating $3,000 to employ an engineer to make preliminary surveys and furnish estimates of the probable cost of the plant.

JACKSON, KY.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 17 for the construction, including mechanical equipment and lighting fixtures, of the United States public building at Jackson, Ky. For further information address the above office. O. Wenderoth is supervising architect.

BEDFORD, IND.—The Southern Indiana Pwr. Co., of Bedford, Ind., which furnishes electricity to stone quarries and mills in the Monroe and Lawrence Counties limestone district, has been taken over by a group of capitalists, headed by Chester P. Wilson, of Indianapolis, president of the Interstate Pub. Ser. Co., of Indianapolis. The new owners, it is said, contemplate the construction of another power dam at Shoals, on the White River, to furnish electrical energy in French Lick, West Baden and other southern Indiana cities. The new officers are: Chester P. Wilson, president; Frank P. Smith, Whiteland, vice-president, and Ira E. Guthrie, of Indianapolis, secretary and treasurer. The Southern Equipment & Supply Co., which handles heavy electrical and quarrying supplies, has also been taken over by the new officials.

COVINGTON, IND.—Improvements have been made to the municipal electric-light plant recently, consisting of the installation of the pumps (Dean Brothers). Two 150-hp Brownell boilers were installed last fall. New posts carrying five-lamp clusters are being installed (a few at a time) as arc lamps are taken down. Charles A. Baldwin is city clerk.

ELKHART, IND.—The Elkhart Manufacturers' Association contemplates the construction of a power plant on the site of the old mill, near the junction of Beardsley Avenue and Riverside Drive, at a cost of about $50,000, to furnish electricity to operate plants owned by the association. It is proposed to equip the plant with three units of 250 hp each.

MARTINSVILLE, IND.—The City Council has authorized the installation of electric lamps in the outlying sections of the city and has also provided funds for the erection of cluster lamps at the city hall.

MONTPELIER, IND.—The Montpelier Utilities Co. is now installing two Heine water-tube boilers having a working pressure of 180 lb. Last January the company installed one directly connected unit (60 cycles, three-phase, 2300 volts), and it expects to install a second unit this summer.

OAKLAND, IND.—The Oakland City El. Lt. & Pwr. Co. has recently changed the street-lighting system from inclosed-arc lamps to series incandescent lamps. The street-lighting system consists of 51 lamps. George W. Clark is manager.

SHERIDAN, IND.—The Sheridan Wtr., Lt. & Ht. Co. is now installing an additional pump in its water-works system and has recently completed the installation of a 10-ton ice plant, manufactured by the Vogt Co., of Louisville, Ky., to be operated by exhaust steam. C. E. Layton is secretary and treasurer.

SOUTH BEND, IND.—The Indiana Public Service Commission has approved the application of the Indiana & Michigan Co., of South Bend, to issue $500,000 in bonds at 85. The Michigan Railroad Commission has passed favorably on the same petition.

THORNTON, IND.—Within the next 12 months the managers of the municipal electric-light plant expect to purchase a few electrical appliances, including cooking apparatus, electric irons, etc. E. P. Rose is town clerk and treasurer.

GENESEO, ILL.—A movement has been started favoring the establishment of a municipal electric and gas plant or taking over the plant of the Illinois Northern Utilities Company, which now serves the city. Under the terms of the franchise the city may at the expiration of any five-year period take over the system of the company. One of the periods will expire next December.

MACOMB, ILL.—Bids will be received at the office of the supervising architect, Washington, D. C., until June 15 for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Macomb, Ill. Drawings and specifications may be obtained upon application to the above office or from the custodian of site. O. Wenderoth is supervising architect.

MOUNT CARMEL, ILL.—The Mount Carmel Pub. Utility & Ser. Co. has recently placed contracts for a new 250-hp Stirling boiler and De Laval centrifugal pump of 1,000,000-gal. capacity, to be installed at once. The company may possibly install a new generating unit during the summer. Phillip Barnard is secretary and treasurer.

MOUNT VERNON, ILL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 18 for the construction, including mechanical equipment, lighting fixtures and approaches, of the United States public building at Mount Vernon. Further information will be given upon application to the above office. O. Wenderoth is supervising architect.

OLNEY, ILL.—Bids will be received by J. C. Howard, secretary school board, Olney, until May 25 for the construction of township high school building. Separate bids will be received for electric wiring; also for heating and ventilation and for plumbing. Plans may be seen at the office of the secretary and may be obtained from L. H. Osterhage, architect, Second National Bank Building, Vincennes, Ind., upon receipt of $10, which will be refunded upon return of plans.

PLANO, ILL.—The Illinois Northern Utilities Co., of Dixon, Ill., has been granted a 25-year franchise in Plano. The City of Plano has also executed a contract with the company for street-lighting and for pumping the city water for a period of 25 years. The contract provides for 150 tungsten lamps of 80 cp, erected on four-ft. goose-neck fixtures, for lighting the streets, and 55 hp for pumping load. An ornamental street-lighting system is under consideration.

RANKIN, ILL.—A mutual company is being organized by local business men to erect an electric-light plant in Rankin. Scott Johnson is interested in the project.

SHELDON, ILL.—At an election held recently the proposal to establish a municipal electric-light plant at Sheldon was carried.

SPRING VALLEY, ILL.—Within the next three months the Spring Valley Gas & El. Co. expects to install a 300-kw directly connected steam-driven generating unit.

THOMASBORO, ILL.—The Champaign County El. Co., of Urbana, has applied to the Public Utilities Commission for a certificate of convenience and necessity to operate in Thomasboro.

WELDON, ILL.—Within the next two or three months the Village Board expects to

purchase some poles, wire and meters. The Commercial Club is considering the question of installing a cluster-lamp lighting system on Main Street. George Gallaher is engineer and electrician.

EAU GALLE, WIS.—The Durand Lt. & Pwr. Co., of Eau Galle, has begun work on the installation of a new power plant. The equipment will include one 265-hp and one 110-hp waterwheel, one Woodward or Lombard (oil) waterwheel governor and one 225-kva, three-phase, 60-cycle, 6600-volt generator. E. M. Miles is engineer in charge.

KENDALL, WIS.—Arrangements are being made by the Kendall El. Co. for the installation of a new power plant.

ROME, WIS.—The power plant of the Bark River El. Lt. & Pwr. Co., it is reported, was recently destroyed by fire.

BARNESVILLE, MINN.—Steps have been taken for the installation of an ornamental street-lighting system here. Louis Norby is chairman of committee.

BEMIDJI, MINN.—The City Council is considering the installation of an ornamental street-lighting system.

BLUE EARTH, MINN.—The Board of Public Works, it is reported, has been authorized to expend $2,000 for equipping the water-works pumping station with electrically operated machinery.

HIBBING, MINN.—The Village Council is contemplating the installation of a new electric-light plant. W. J. Ryder is a member of the water and light board.

MADELIA, MINN. — The Consumers' Pwr. Co., of St. Paul, is to furnish energy for lamps and motors in Madelia, to be transmitted over a 9-mile transmission line being erected by the local distributing company.

VIRGINIA, MINN.—Bids will be received by H. J. Nathanson, secretary, City Hall, Virginia, until May 22, for furnishing a complete lighting system in Olcott Park and South Park, in accordance with specifications on file in the office of the secretary.

CEDAR RAPIDS, IA.—Bids will be received at the office of the board of education, Cedar Rapids, Ia., until June 4 for construction and completion of the Hayes grade school building at D Street and Twentieth Avenue West, according to plans and specifications prepared by the Ingold Unit System Co., of Cedar Rapids. Plans may be obtained upon application to the architect, for which a deposit of $15 will be required, to be refunded upon return of same. J. M. Ingold is secretary of board.

DAVENPORT, IA.—The State Automatic Tel. Co., recently organized, is planning to install a local system, consisting of 173 miles of cable, and will erect a telephone exchange building, at a cost of $45,000. E. H. Moulton, of Minneapolis, Minn., is president, and B. H. Osborne, of Franklin, Pa., secretary.

DELMAR, IA.—The installation of an electric-lighting plant in Delmar is reported to be under consideration. Electricity for operating the system will be secured from the plant in Maquoketa.

DENISON, IA.—Negotiations have been closed whereby the city of Denison has taken over the property of the Denison El. Lt. & Pwr. Co., at $28,000. Work will begin immediately on the construction of a new building. New machinery will also be installed.

DES MOINES, IA.—Within the next six months the Des Moines El. Co. expects to erect a 33,000-volt transmission line from Des Moines to Oskaloosa, a distance of about 66 miles, and to purchase material for smokestack (225 ft. high and 15 ft. in diameter); also material for enlarging power house to provide space for two additional 600-hp boilers and to purchase two 600-hp boilers. Contracts have already been placed for one 4000-kw turbo-generator set, with condenser and accessories. The company also expects to erect within the next four months about 4 miles of single-phase, 2200-volt distribution line within the city limits, to be used for lighting purposes. George B. Brush is operating engineer.

DUMONT, IA.—The Hampton Lt. & Pwr. Co., of Hampton, has been granted a franchise to install and operate an electric-light plant in Dumont. Construction work will begin at once.

EARLVILLE, IA.—The installation of an electric-light plant in Earlville is reported to be under consideration.

GREELEY, IA.—Bids will be received by the town of Greeley until May 28 for construction of electric-light system as follows: One 50-hp oil engine, one 30-kw, 125/250-volt, three-wire generator, one 25-amp capacity for eight hours, 62 cell and eight counter-cell storage battery; 2450 ft. No. 2 weather-proof, triple-braid copper wire, 6200 ft. No. 6 weather-proof, triple-braid copper wire, 12,700 ft. No. 8 weather-proof, triple-braid copper wire, 24,700 ft. No. 10 weather-proof, triple-braid copper wire; pole line material, including poles, cross-arms, guy wires, cast-iron lamp-posts, street lamps, etc. Plans and specifications and proposal forms may be obtained from V. E. Dow, town clerk, Greeley, or from the Alamo Engine & Supply Co., Omaha, Neb., upon deposit of $5, which will be refunded upon return of plans.

MILFORD, IA.—A high-tension transmission line is being erected from Arnold's Park to Milford, to furnish electricity here. Local parties are interested in the project.

NORA SPRINGS, IA.—Bids will be received by the Independent School District of Nora Springs until May 25 for construction of school building, including electrical work, heating and plumbing. Plans and specifications may be obtained from Alban & Lockhart, 40 Chamber of Commerce Building, St. Paul, Minn., for which a deposit of $10 will be required, to be refunded upon return of plans. H. F. Schnedler is secretary of board of education.

OAKLAND, IA.—The local electric-light plant has been purchased by the Red Oak El. Co., of Red Oak. Steps will be taken to secure a franchise from the Board of Supervisors of Mills County to erect a transmission line from Malvern to the county line. It is proposed to furnish electricity from the Malvern plant to operate the system here.

SHELLSBURG, IA.—A franchise has been granted to F. J. Cross to install and operate an electric-light plant here.

SPIRIT LAKE, IA.—Dr. A. L. Peck, of Arnold's Park, is erecting a high-tension transmission line from Arnold's Park to Spirit Lake, to furnish electrical service here.

OZARK, MO.—The Public Service Commission has granted the Ozark Wtr. & Pwr. Co. permission to issue $2,000,000 in bonds.

BOWMAN, N. D.—The installation of an electric-light plant in Bowman is reported to be under consideration.

TOWER CITY, N. D.—Preparations are being made for the installation of an electric-light plant in Tower City. The equipment will include one direct-current generator, driven by a gasoline or kerosene engine, switchboard, etc. Contract for construction of plant will soon be awarded. S. F. Sherman is interested.

NORTH LOUP, NEB.—Bruce & Standevin, engineers, 604 Bee Building, Omaha, have been engaged to prepare plans for the proposed municipal electric-light plant in North Loup.

OMAHA, NEB.—The Omaha El. Lt. & Pwr. Co. has submitted a proposal to the City Council offering reduced rates for street-lighting if given an extension of its contract for five years. The company offers to install within seven months after the contract is entered into 2000 incandescent lamps of 400 cp each at $35 each per year, with overhead service and $40 each with underground wiring. The city now pays $57.50 each for 1387 arc lamps. The company also proposes to install 200 10-amp flaming arc-lamps in a district bounded by Cuming, Leavenworth and Twenty-fourth Streets, within six months after the contract is signed, at $60 each per year.

SYRACUSE, NEB.—The Nebraska City Wtr. & Lt. Co., of Nebraska City, has submitted a proposition to local business men offering to erect an electric transmission line to Syracuse to furnish electricity for lamps and motors here.

LEAVENWORTH, KAN.—Bids will be received at the office of the superintendent of prisons, Department of Justice, Washington, D. C., until June 5 for furnishing material required for electric-light, telephone and clock installations and lumber at the United States penitentiary at Leavenworth, Kan. Copies of specifications, together with further information, may be obtained upon application to the above office. F. H. Duehay is superintendent of prisons.

MANHATTAN, KAN.—The Manhattan Ice, Lt. & Pwr. Co. has recently installed a new substation and switchboard; also a 38-kva, three-phase feeder regulator, manufactured by the Westinghouse company. The company has also just completed the installation of ornamental lamps on three blocks. E. A. Wright is manager.

McPHERSON, KAN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 15 for the construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at McPherson, Kan. Drawings and specifications may be obtained at the above office and from the office of the custodian of site at McPherson.

OSAWATOMIE, KAN.—The electric light and water commissioners may purchase a car load of poles some time this year. B. L. Prier is superintendent of the light and water department.

Southern States

CENTER FALLS, N. C.—The Center Falls Pwr. Co., recently incorporated, has engaged the J. B. McCrary Co., engineer, of Atlanta, Ga., to take charge of the construction of its proposed plant.

GASTONIA, N. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 16 for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Gastonia, N. C. Drawings and specifications may be obtained from the above office or from the custodian of site at Gastonia. O. Wenderoth is supervising architect.

WALNUT COVE, N. C.—The Walnut Cove Pwr. Co. is reported to be contemplating the installation of an electric-light system. J. Wesley Morefield & Son are reported to be interested in the company.

BENNETTSVILLE, S. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 11, for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Bennettsville, S. C. Drawings and specifications may be obtained from the above office or from the custodian of site at Bennettsville. O. Wenderoth is supervising architect.

CALDWELL, GA.—The City Council has awarded the contract for the installation of a municipal electric-light plant to the Modern Equipment Co., of Savannah, Ga.

EATONTON, GA.—The proposal to issue $25,000 in bonds for purchasing and developing the water-power at Griffin Mill and installing an electric system will be submitted to the voters on June 8. For further information address M. A. Shivers, chairman of special committee of water and light board.

SAVANNAH, GA.—The Savannah Ltg. Co. will install a new switchboard for main station and substation and also make a complete rearrangement of its transmission and distribution lines. The company has recently placed contracts for new machinery and equipment as follows: One 3750-kva General Electric turbine, three 375-hp Babcock & Wilcox boilers with superheaters, one 100-kw General Electric exciter set, one Crocker-Wheeler condensing set driven by a Kerr steam turbine, five 1500-kva high-tension General Electric transformers, and 5000 ft. of high-tension cable. S. O. Sauls is secretary and treasurer.

WAYCROSS, GA.—The Ware County Lt. & Pwr. Co., of Waycross, expects to purchase within the next three months a deep-well pump with a capacity of about 500 gal. per minute. Within the past 12 months the company has installed a 500-kw General Electric Curtis steam-turbine and Babcock & Wilcox boilers, superseding a gas producer outfit and gas engines. H. C. Gamage is manager.

AVON PARK, FLA.—Application, it is reported, has been made to the Town Council for a franchise to install an electric-light plant.

EUSTIS, FLA.—The Eustis Wtr., Lt. & Pwr. Co. has recently purchased a generating unit, consisting of one 125-kva alternator and Skinner engine (15 in. by 16 in.) and motor generator set. The company is also erecting a transmission line to Umatilla and Fola, 5 miles long, material for which has been purchased. C. A. Childs is president.

MIAMI, FLA.—The Tatum Brothers, Real Estate & Investment Co., of Miami, it is reported, is contemplating the construction of a power plant to furnish electricity to operate a street-railway system.

OCALA, FLA.—The Florida Pwr. Co., of Ocala, is erecting a substation in Inverness. The equipment will consist of two 200-kw transformers, stepping down the voltage from 60,000 volts to 550 volts, electrolytic lightning arresters and necessary switching apparatus. The station will serve the Southern Phosphate & Development Co.'s phosphate plant. R. C. Camp is president of the Florida Pwr. Co.

COVINGTON, TENN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 13 for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Covington, Tenn. Drawings and specifications may be obtained at the above office or from the custodian of site at Covington. O. Wenderoth is supervising architect.

MEMPHIS, TENN.—Plans and specifications are being prepared for equipment for the North Memphis pumping station, for which bids will soon be asked. The equipment will consist of four 6-ft. centrifugal pumps, each having a capacity of 135,000 gal. per minute; two 4-ft. centrifugal pumps of 45,000 gal. each per minute, and two priming pumps of 3000 gal. capacity each per minute. Each 6-ft. pump will be driven by an 800-hp alternating-current motor, and the 4-ft. pumps by a 400-hp motor. Bids for supplying a 20-ton traveling crane, transformers, electrical wiring and extra piping will also be asked for. At the same time bids will be advertised for building pumping station (60 ft. by 160 ft.) of concrete construction, which will include foundations for machinery and lifting the gates of the bayou. J. H. Weatherford is city engineer.

WINCHESTER, TENN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 12, for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Winchester, Tenn. Plans and specifications may be obtained at the above office or from the custodian of site at Winchester. O. Wenderoth is supervising architect.

OZARK, ALA.—Preparations are being made to install new equipment in the municipal electric-light plant, including one 200-kw generator, one 300-hp Corliss engine and switchboard, work on which will begin in about 60 days. Contracts have not yet been awarded. B. C. Darling, superintendent, will have charge of the work.

GREENVILLE, MISS.—The power plant of the Delta El. Lt. & Pwr. Co., of Greenville, was recently damaged, putting the plant out of commission for several days. The large smokestack was blown down and crushed through the roof of the building. The electric plant at Lake Village, which secures power from the Greenville plant, was also put out of commission.

GRENADA, MISS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 16 for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Grenada, Miss. Drawings and specifications may be obtained upon application to the above office or from the custodian of site at Grenada. O. Wenderoth is supervising architect.

JONESBORO, ARK.—The board of directors of the State Agricutural College has authorized the rebuilding of the electric plant, recently destroyed by fire.

PLAINVIEW, ARK.—The Plainview Light Co. is contemplating the installation of an electric-light plant in Plainview, to cost about $5,000. W. W. Winters, of Danville, is interested in the project.

BELTON, TEX.—The property of the Belton Lt. & Pwr. Co. is reported to have been purchased by the Texas Pwr. & Lt. Co., of Dallas.

EL PASO, TEX.—The El Paso El. Ry Co. is preparing to install additional machinery in its power plant, work on which will begin June 1. The equipment will include one 5000-kw Allis-Chalmers steam turbo-generator, one 1000-kw Westinghouse motor-generator set for street railway service, General Electric switchboard equipment, two 600-hp Babcock & Wilcox water-tube boilers, two Foster superheaters for boilers, two chain-grate equipments for above boilers and one self-supporting steel stack (153 ft. high and 11 ft. in diameter). Contracts for machinery have been awarded. The Stone & Webster Engineering Corpn., of Boston, Mass., has charge of the work.

GALVESTON, TEX.—Bids will be received by John D. Kelly, city secretary, Galveston, until May 28 for furnishing 18 ornamental posts (combination trolley and arc-lamp design) and 34 ornamental posts for arc lamps only; also for 52 ornamental inverted arc lamps and for complete installation of posts and lamps, and also for installation of approximately 12,000 ft. of cable, in accordance with specifications which are on file in the office of the secretary. Specifications may be seen at the office of W. D. Masterson, city superintendent of electricity.

Pacific States

CHEHALIS, WASH.—Application has been made to the Council by Benjamin Walling, Jr. It is understood that he represents a capitalist who contemplates building a power plant to furnish electricity to cities in southwest Washington.

SPOKANE, WASH.—The Washington Wtr. Pwr. Co., of Spokane, has purchased the transmission lines of the Lewiston-Clarkston Improvement Co., of Lewiston, Idaho, extending from Leon Station, Idaho, to Moscow, Pullman, Uniontown, Genesee and Colton. The local distributing systems in the towns mentioned were purchased by the Washington Wtr. Pwr. Co. last summer. surveys have been made to Troy, Kendrick and Julietta, and it is expected that a transmission line will soon be erected into that territory.

WENATCHEE, WASH.—The Chicago, Milwaukee & St. Paul Ry. Co. has recently purchased large tracts of land on both sides of the Columbia River, below Priest Rapids, where, it is reported, a large power plant will be erected to supply electricity for the railway lines of the company between Wenatchee and Spokane. It is understood that a large dam will be built about 15 miles below Beverly.

CANYONVILLE, ORE.—Application has been filed by David A. McKeown, of Prairie City, for a permit to appropriate additional water from Strawberry Creek, in order to develop 1527 hp.

PORTLAND, ORE.—The City Council has granted the merchants on Third Street, between Yamhill and Burnside, permission to erect a series of illuminated arches at street intersections.

ROSEBURG, ORE.—The California-Oregon Pwr. Co. has petitioned the Douglas County Court for permission to erect a transmission line from Glendale to the city limits of Roseburg. If granted a franchise, the company will extend its lines from Glendale to Riddle and thence to Myrtle Creek and possibly to Canyonville, with service wires branching wherever needed.

HANFORD, CAL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 18 for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Hanford, Cal. Drawings and specifications may be obtained at the above office or from the custodian of site. O. Wenderoth is supervising architect.

LOS ANGELES, CAL.—At an election held May 8 the proposal to issue $6,500,000 in bonds to complete the aqueduct power project and for distribution system for same was carried.

SAN FRANCISCO, CAL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 10 for furnishing and installing lighting fixtures in the United States sub-treasury at San Francisco, Cal., in accordance with specifications and drawings, copies of which may be obtained at the above office.

SAN FRANCISCO, CAL.—The Board of Supervisors has appointed Prof. W. F. Durand, of Stanford University, and John D. Galloway and F. G. Baum, of San Francisco, as a board of hydroelectric engineers for the purpose of advising as to plans for the first hydroelectric development in connection with the construction of the Hetchy-Hetchy water-power supply system.

CULDESAC, IDAHO.—W. J. Morrow, of Cœur d'Alene, has applied to the City Council for a franchise to construct and operate an electric-light plant in Culdesac. He proposes to build a dam across Lapwai Creek.

TWIN FALLS, IDAHO.—The Farmers' El. Co., it is reported, will establish a power plant in Twin Falls at once.

SALT LAKE CITY, UTAH.—R. S. Campbell has applied to the City Commission for a franchise to construct conduits through the commercial district for a heating and power distribution system. A company, to be known as the Public Utility Co., will be organized by Mr. Campbell and associates to install and operate the system.

NOGALES, ARIZ.—Application has been made to the Council by S. S. Proctor and M. M. Mansfield for an electric-light and power franchise in Nogales. An election will be held May 25 to submit the franchise to the voters.

GLASGOW, MONT.—Within the next two months the electric-light committee expects to purchase one 50-kw, three-phase, 60-cycle, 2300-volt generator, with directly connected exciter, one four-panel General Electric switchboard, one condenser, and one compound Ideal engine; also to purchase within the next 30 days 69 luminous-arc lamps (26 6.6-amp and 45 4-amp), one 25-lamp, 6.6-amp mercury-arc rectifier and one 50-lamp, 4-amp mercury-arc rectifier. A. J. Melvin is superintendent.

PHILLIPSBURG, MONT.—The Royal Basin Mining Co. is contemplating the construction of an electric power plant on Flint Creek, a short distance below Maxville.

Canada

VANCOUVER, B. C.—The question of equipping the Canadian Pacific Railway between Vancouver and New Westminster for electrical operation is reported to be under consideration.

VANCOUVER, B. C.—Plans have been prepared for the installation of ornamental street lamps. The plans provide for the erection of 50 standards, each carrying five 100-watt lamps, maintained by underground wires, at a cost of about $7,800. About 4900 ft. of underground conduit will be laid and lead-covered, rubber-insulated wire will be used. Contract for part of the work has been awarded. C. H. Fletcher, city engineer, has charge of the work.

SHOAL LAKE, MAN.—Tenders will be received until May 28 for various contracts in connection with the installation of an electric-light plant in Shoal Lake, plans and specifications for which may be obtained from the John Galt Engineering Co., consulting engineers, Winnipeg, Man., and Calgary, Alta.

STAMFORD, ONT.—A by-law authorizing an appropriation of $40,000 to purchase the plant and equipment of the Ontario Distributing Co. in Stamford has been adopted by the Township Council. The company, it is understood, will sell the property for $33,000; the remainder will be used for improvements to the plant and extending the lines. The by-law will be submitted to the rate-payers in June.

TILBURY, ONT.—The Town Council, it is reported, will purchase the local electric-light plant, owned by Thomas C. Vickerman, and operate part of it in connection with the hydroelectric system soon to be installed.

SASKATOON, SASK.—At an election held recently the by-laws to appropriate $15,000 for a new power house and $200,000 for extensions to electric light and power plant in Saskatoon were defeated.

SASKATOON, SASK.—Tenders will be received by the city commissioners, Saskatoo, Sask., until May 30, for furnishing and installing the following equipment in the municipal power plant: Two 750-hp water-tube boilers, two chain-grate stokers, two sets of economizers and two sets of superheaters. Specifications, tender forms, etc., may be obtained from E. Hanson, city electrical engineer.

SWIFT CURRENT, SASK.—The contract for the construction of the power house for the municipal electric-light plant is reported to have been awarded to Gilstrom Brothers, of Swift Current, at $21,000.

Miscellaneous

KAUAI, HAWAII.—The House committee on territories at Washington has practically reported the bill to authorize the establishment of an electric-light and power plant and distributing system in the county of Kauai, Hawaii.

New Incorporations

PARKER, ARIZ.—The Colorado River El. Ry. Co. has been chartered with a capital stock of $250,000 by Thomas Taylor, David Connor, J. E. Beck, W. H. Thorpe, I. W. Wallace and William Drury. The company proposes to construct and operate electric railways and to maintain telephone and telegraph system in and around Parker and throughout the Colorado River Indian Reservation.

SHEFFIELD, MASS.—The Sheffield El. Lt. & Pwr. Co. has been organized for the purpose of furnishing electricity in Sheffield and Ashley Falls. Electricity for operating the system will be secured from the Berkshire Pwr. Co., of Canaan, which will extend its transmission line to the Massachusetts line. The officers of the company are: Walter S. Van Deusen, of Ashley Falls, president, and H. C. Clark, secretary and treasurer.

BELLINGHAM, MINN.—The Bellingham El. Lt. Co. has been incorporated by L. F. Clarke and others.

GRANITE FALLS, MINN.—The Stony Run Lt. & Pwr. Co., of Stony Run Township, has been incorporated by John J. Mooney and others.

SPENCER, S. D.—The Spencer Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 by William Hoese, H. C. Sleuth and others.

HOUSTON, TEX.—The Houston El. Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 by M. C. Cayce, E. K. Lyles and C. E. Coleman.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 5, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,095,182. Trolley Harp or Head; J. J. Barnick, Bloomsburg, Pa. App. filed April 22, 1911. Quickly detachable self-locking trolley harp.

1,095,214. Electric Cooker; F. Johnson, Winnipeg, Manitoba, Canada. App. filed July 3, 1913. Open-topped casing with a cooking grate and coreless heating coils below the same.

1,095,235. Electric Signal for Hay Presses; C. Schade, Cropsey, Ill. App. filed Oct. 28, 1913. Sounds after a predetermined amount of hay has been passed so as to insure uniform bales.

1,095,273. Testing Device for Gas Engines; W. C. Force, North Plainfield, N. J. App. filed April 28, 1913. For short-circuiting the spark plugs.

1,095,284. Instrument for Locating Breaks and Grounds in Electric Wires; M. J. Myers (deceased), F. O. Myers, administratrix, Syracuse, N. Y. App. filed May 5, 1910. For comparing capacity or resistance of circuits.

1,095,279. Electric Switch; R. C. Hull, Germantown, Pa. App. filed Dec. 4, 1912. Push-button type with lock.

1,095,300. Arc Welding Apparatus; T. Varney, Pittsburgh, Pa. App. filed Sept. 18, 1911. For maintaining welding current substantially constant.

1,095,328. Plating Apparatus; J. H. Jordan, St. Louis, Mo. App. filed July 9, 1913. Terminal arms extend inwardly at ends of rotating article containing drum.

1,095,331. Field-Magnet Winding for Dynamo-Electric Machines; B. G. Lamme, Pittsburgh, Pa. App. filed Jan. 26, 1910. For single-phase commutator motor.

1,095,342. Wireless Receiver; H. Merton, London, England. App. filed May 8, 1913. Keeps a record of messages received.

1,095,354. Telephone Transmitter; J. Redding, Malden, Mass. App. filed June 17, 1910. For high-voltage currents.

1,095,357. Process for the Production of Varied Colorations and Black Shades on Metals; F. A. Roux, Paris, France. App. filed Jan. 19, 1914. Electrolytic bath.

1,095,358. Call Box; H. O. Rugh, Sandwich, Ill. App. filed Nov. 13, 1909. Impulse-sending mechanism at central station.

1,095,365. Oil-Well Heater; J. E. Williamson, Pittsburgh, Pa. App. filed Aug. 30, 1909. The metallic sand line forms one side of the heater circuit.

1,095,379. Roentgen-Ray Apparatus; S. Cabot, Brookline, Mass. App. filed Sept. 23, 1912. Employs a charged condenser.

1,095,382. Alarm Press-Button Contact; A. V. and O. T. Clorius, Copenhagen, Denmark. App. filed April 8, 1913. Push-button contact is simultaneously employed for a fire-alarm contact.

1,095,387. Engine Starter; H. N. Edens, New Holstein, Wis. App. filed June 28, 1912. Special timing of magneto.

1,095,392. Electrically Heated Waving Tongs; L. Frey, Munich, Germany. App. filed Aug. 28, 1913. Heating resistances are carried in the operative legs of the tongs.

1,095,405. Heating Apparatus; C. Kratt, Glasgow, Scotland. App. filed Sept. 29, 1913. Liquid heater in which oscillatory lever first turns on liquid and then throws on switch.

1,095,425. Process and Apparatus for the Production of Long Continuous Electric Arcs; O. Schönherr and J. Hessberger, Dresden-Striesen, Germany, and Christiansand, Norway. App. filed May 18, 1910. Causes currents of gas to pass in opposite directions lengthwise of the arc.

1,095,426. Process of Producing Long Continuous Electric Arcs; O. Schönherr and J. Hessberger, Dresden-Striesen, Germany, and Christiansand, Norway. App. filed May 18, 1910. Gas flows into mid-part of space surrounding the arc and toward opposite ends of the same.

1,095,427. Means for the Production of Long Continuous Electric Arcs; O. Schönherr and J. Hessberger, Dresden-Striesen, Germany, and Christiansand, Norway. App. filed May 18, 1910. Embodies conical electrode into which gas is caused to flow.

1,095,437. Spark-Coil; C. R. Underhill, Muskegon, Mich. App. filed Feb. 10, 1911. Vibrator having adjustable armature and adjustable as to tension.

1,095,439. Ground Detector for Insulators; J. Wahn, Vienna, Austria-Hungary. App. filed Feb. 2, 1912. Conductor separating main and secondary insulators and fusible means between conductor and the customary pin.

1,095,453. Motor Mechanism; C. W. Coleman (deceased), Westfield, N. J. App. filed Sept. 10, 1910. "Top-post" motor mechanism for semaphores.

1,095,473. Apparatus for Treating Articles with X-Rays; F. S. Smith, Philadelphia, Pa. App. filed May 28, 1909. For killing destructive insects which infest tobacco, furs, woolens, etc.

1,095,474. Snap Electric Switch; J. A. Smith, Bellevue, Ky. App. filed Sept. 9, 1912. Has reciprocating finger piece which operates a rock shaft.

1,095,486. Testing Device for Electrical Ignition Apparatus for Explosive Engines; E. Yoss, South Richmond, Va. App. filed July 20, 1912. Switch attachable to spark-plug for producing visible spark gap.

1,095,491. Remote Switch Control for Electrical Circuits; P. C. and C. F. Butte, San Francisco, Cal. App. filed Sept. 3, 1912. Adaptable for installed switches to render them remote-control.

1,095,507. Motor-Controlling System; W. D. Lutz, Allendale, N. J. App. filed Dec. 6, 1909. For effecting dynamic brake action and automatically varying the degree of the brake action.

1,095,512. Combined Gas Supply and Lighting Device; E. R. Mills, Sabina, Ohio. App. filed Feb. 16, 1911. Valve with switch to control flow and lighting of gas auto-lamps.

1,095,525. Call Box; H. O. Rugh, Sandwich, Ill. App. filed May 4, 1909. For selective signaling telephone systems.

1,095,539. Calling Device for Telephone Exchanges; C. A. Anderson, Chicago, Ill. App. filed Jan. 19, 1911. Party-line system.

1,095,557. Electric Vaporizer; C. L. Davis, Detroit, Mich. App. filed Dec. 28, 1912. Heat generated electrically in the center of the fluid column.

1,095,586. Alternating-Current Motor; B. McCollum, Lawrence, Kan. App. filed Nov. 11, 1909. Reversing single-phase motor of variable speed.

1,095,609. Purifying Electrolytes; F. von Kugelgen and F. von Bidder, Holcomb's Rock, Va., and G. O. Seward, East Orange, N. J. App. filed Sept. 16, 1908. Electrolysis of sodium chloride.

1,095,632. Dynamo-Electric Machine; C. J. Heineman and A. H. Hensley, Chicago, Ill. App. filed Sept. 4, 1909. Varies the magnetic flux to produce substantially uniform voltage and current from generator driven at variable speed.

1,095,639. Railroad Switch; A. G. Johnson, Huntington, Ind. App. filed May 13, 1912. Spring and electromagnetically actuated trolley switch operated from car.

1,095,645. Vaporizer for Internal Combustion Engines; E. Koster, Yonkers, N. Y. App. filed Jan. 14, 1914. Gasket applied to intake pipe and carrying heating wire.

1,095,648. Armored Conduit or Conductor; G. A. Lutz, Plainfield, N. J. App. filed July 22, 1910. Outside wire laid over the spirally wound armor.

1,095,655. Selective Signaling Means; J. McFell, Chicago, Ill. App. filed July 27, 1910. Special selector construction.

1,095,664. Make-and-Break Sparking Plug; G. Nagel, Stuttgart, Germany. App. filed Dec. 2, 1911. Compression in cylinder operates the plug to produce the spark.

1,095,666. Telephone System; F. R. Parker and E. R. Corwin, Chicago, Ill. App. filed Dec. 7, 1904. Operation and control of supervisory signals; provides a "dead-ring" on one of the spring jacks.

1,095,686. Electric Lamp for Small Firearms; A. L. Webb, Sudbrook Park, Md. App. filed July 26, 1913. Flash lamp attachable to barrel of revolver.

1,095,692. Food-Conveying System; R. F. Almirall and R. A. McColloch, New York, N. Y. App. filed Nov. 3, 1911. Food car which is lowered in elevator from kitchen travels on tracks to another elevator, where it is raised to final destination.

1,095,722. Secondary or Storage Battery; B. Ford, Philadelphia, Pa. App. filed Jan. 27, 1914. Battery jars placed while plastic in rigid supporting walls, to which they fit themselves and become hardened.

1,095,733. Ground Connector; E. Klein, New York, N. Y. App. filed April 28, 1913. For clamping to a pipe.

1,095,748. Electrolytic Apparatus; W. Thum, Hammond, Ind. App. filed Sept. 23, 1911. Weight of the anodes and cathodes borne by means independent of the containing tank.

1,095,774. Electric Bath; H. Aub, Munich, Germany. App. filed Feb. 21, 1914. Urogenital treatment.

1,095,811. Electric Low-Level Signal for Tanks; O. C. Carr, Lansing, Mich. App. filed July 26, 1912. Flashes light on dashboard to warn of low level of gasoline.

1,095,816. Crossing Arrangement for Block-Signaling Systems; M. Conrad, Adrian, Mich.; W. G. Kelly, Winslow, Ariz. App. filed April 11, 1911. Train-stopping system for crossings.

1,095,845. Electric Mail Box; P. O. Gaudreau, Burlington, Vt. App. filed May 19, 1913. Bell rings when letters or packages are placed in box.

1,095,860. Insulator Holder; H. C. Heffner, Martinsburg, W. Va. App. filed May 25, 1912. Made of wire coiled to take the insulator threads.

1,095,893. Process of and Apparatus for Treating Water; C. P. Landreth, Philadelphia, Pa. App. filed Sept. 13, 1911. Electrodes arranged in banks so that in case of wear or derangement the plates of one bank may be cut out of circuit.

1,095,902. Rear-End Signal for Vehicles; C. F. Marston, Cedarhurst, N. Y. App. filed Feb. 18, 1913. Solenoids lift the signal panels into exposed position.

1,095,925. Creasing Iron; H. W. Pogue, Decatur, Ill. App. filed March 20, 1913. Electric iron with opposed members between which trousers, or parts to be creased, are pressed.

1,095,949. Fire-Alarm Circuit Closer; B. Trent, Clifton, N. J. App. filed April 14, 1911. Fusible member holds movable member away from fixed member.

1,095,950. Device for Disinfecting Telephones; R. B. Adams, L. Adams, C. H. Wells and H. G. Payne, Westerville, Ohio. App. filed Aug. 3, 1911. Atomizing attachment for injecting spray into transmitter mouthpiece.

1,095,957. Electric-Bath Cabinet; G. B. Campbell, White Bear, Minn. App. filed Feb. 19, 1914. Table support for the patient, movable to carry the patient from outside into the bath casing.

1,095,967. System of Propulsion; J. T. Lister, Cleveland, Ohio. App. filed Nov. 7, 1910. Embodying engine-driven generator and storage batteries.

1,095,982. Railway Block Signal and Train-Controlling System; G. R. Guild, U. S. A., App. filed Jan. 9, 1911. Has third-rail divided into blocks corresponding to blocks in the track rails.

1,095,985. Combined Magneto and Battery Ignition System; T. M. Mueller, Pittsfield, Mass. App. filed June 30, 1909. Battery may be switched in to supplement the magneto.

1,095,990. Trolley; C. A. Soule, Canandaigua, N. Y. App. filed Feb. 11, 1910. Wheel spindle carried by insulating collars and current carried to harp by brushes.

1,096,004. Temperature Regulator; W. B. Dahl, Minneapolis, Minn. App. filed Oct. 25, 1912. Thermostatic strips held together by stamping portions of one strip into and over portions of the other strip, thus avoiding the customary welding.